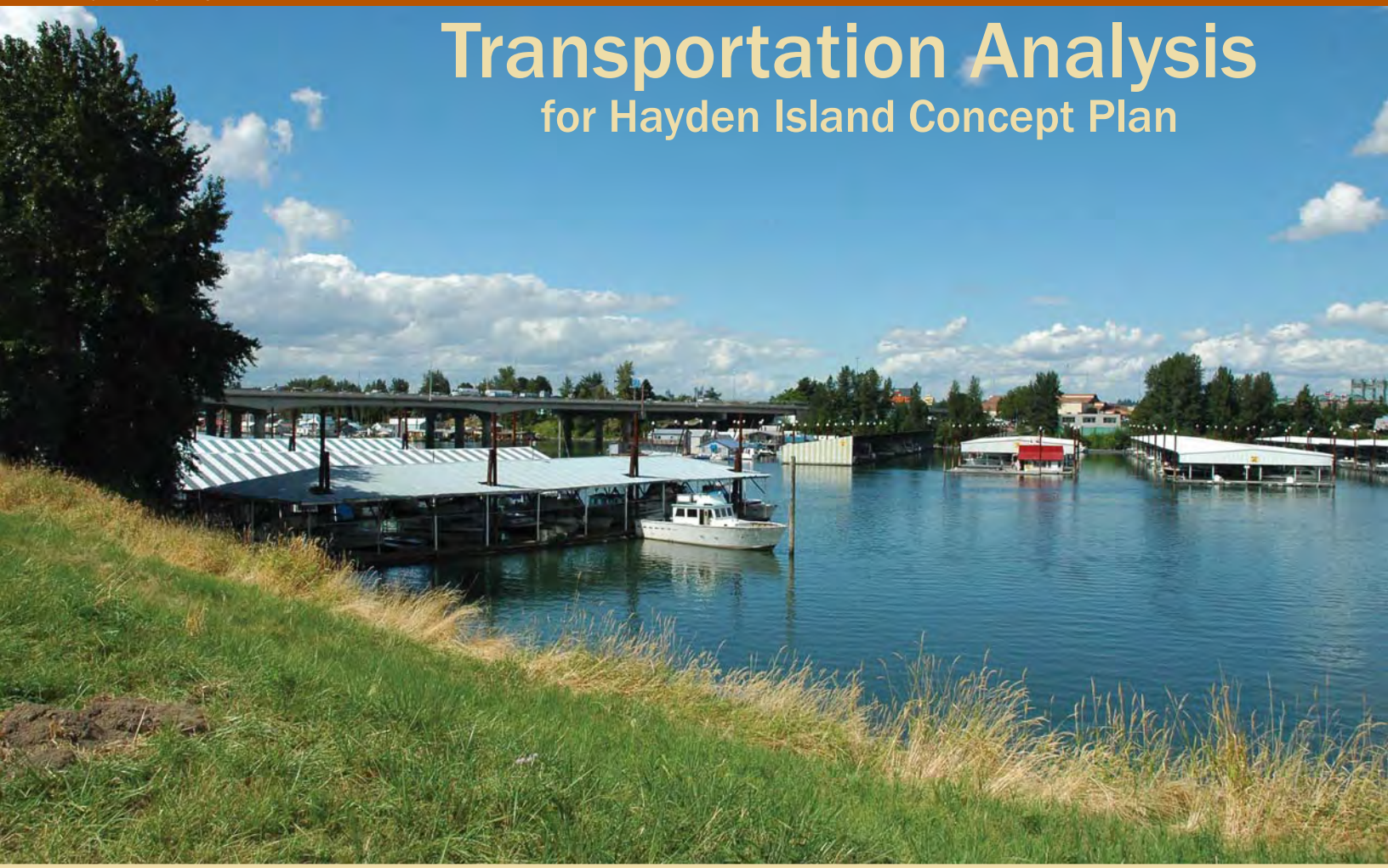
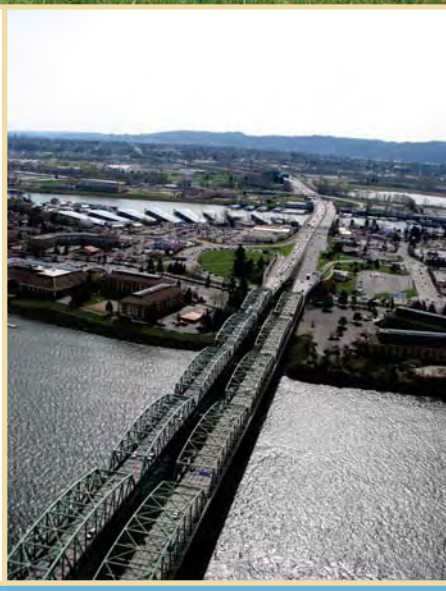
Transportation Analysis
for Hayden Island Concept Plan





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CITY OF PORTLAND BUREAU OF PLANNING

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City of Portland, Bureau of Planning

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July 2008

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Executive Summary

The Hayden Island Concept Plan is the result of the planning process undertaken by a partnership of residents and businesses on Hayden Island, staff members of several bureaus at the City of Portland, and other public agencies. The goal of the Concept Plan is to create a vibrant, livable community on Hayden Island that promotes diverse land uses, is integrated with the natural environment, and has safe and reliable transportation options.

This technical report details the development of and results of the transportation analysis of the Concept Plan. It describes the underlying assumptions that affected the development of the Concept Plan and provides some background for ongoing and previously completed transportation work on Hayden Island. Additional data is presented to further describe existing conditions – land use, trip generation, and traffic operations. The final section on background information compares the land use assumptions for three scenarios: the existing conditions; a previously evaluated land use scenario; and the preferred land use developed for the Concept Plan.

The traffic analysis for the Concept Plan uses a process that accounts for 1) trip generation, 2) trip distribution; 3) modal choice; and 4) traffic assignment. This report describes the assumptions and methodology for each of these steps. Results of the traffic operational analysis are presented for two scenarios involving different access spacing for the east side of the interchange. The results of the overall analysis are evaluated and a set of conclusions is drawn and described. A series of next steps to further refine the analysis is presented.

In addition, a street classification scheme is proposed that identifies roads that would function as primary vehicle, transit and freight routes and those which would serve secondary functions. Routes that would best serve pedestrians and bicycles are also identified.

Finally, the potential traffic impacts are discussed for a possible arterial bridge between Marine Drive and Hayden Island. The process of selecting the most appropriate location for the bridge is also described, along with a summary of why other alternatives have been rejected.

1. INTRODUCTION

1.1. Purpose

This report describes the transportation analysis conducted for the proposed Hayden Island Concept Plan. It provides information on the assumptions, methodology, and traffic operations analyses of the Concept Plan, and compares the results against existing conditions and previously studied plans. An analysis of possible locations of an arterial bridge to Hayden Island is included in the report. In addition, the report proposes a preliminary street classification for the Concept Plan.

1.2. Relationship to Other Work

The information presented in this report draws upon previously completed analyses and the ongoing work of the Columbia River Crossing (CRC) project. Key studies specific to Hayden Island are summarized below, beginning with the most recent.

The *Existing Conditions Report for Hayden Island*, completed by David Evans and Associates and Parisi Associates in February 2008 as part of the Hayden Island Concept Plan process, contained a street and parking inventory of the island. The report also summarized information about existing travel demand, vehicle origin-destination patterns, local street operational performance, and freeway operational performance for I-5 in the vicinity of the Hayden Island interchange.

The *Traffic Access, Traffic Circulation and HCT Station Location Special Technical Study*, completed by David Evans and Associates, Parisi Associates, and Parsons Brinckerhoff for the Portland Department of Transportation (PDOT) in March 2007, examined the traffic impacts of three potential land use scenarios for the 2030 time period.

The *Hayden Island Technical Memorandums (Summarizing Capacity Analysis of I-5 Freeway in Vicinity of Hayden Island, Hayden Island Intersection and Ramp Terminal Queuing Capacity Analysis,* and *I-5 Crash History in Vicinity of Hayden Island)*, completed by David Evans and Associates and Parisi Associates for PDOT in August 2006, examined the operational performance of the Hayden Island local street network and provided information about the performance of I-5 on Hayden Island. The analysis was used by the Portland City Council to support the need for a temporary development moratorium for Hayden Island.

The *Port of Portland's West Hayden Island Transportation Analysis*, prepared by Parametrix, Inc. and published in 1999, presented an analysis of several marine-oriented facility options for West Hayden Island. A section of the Port's study examined the trip generation characteristics of the different marine-oriented operations. The study also looked at options for a bridge between Marine Drive and Hayden Island and other opportunities to improve railroad access to the island.

1.3. Contents of this Report

The four main sections of this report present information related to:

- Existing conditions, including information on current land uses, the transportation network and traffic operations;
- A comparison of the existing land use with two possible future scenarios: one based on the current plan and a second based on the preferred development scenario presented by the new Hayden Island Concept Plan;
- A more detailed transportation analysis of the development scenario from the Hayden Island Concept Plan including recommendations for a transportation system to serve that development concept; and
- An evaluation of four proposed arterial bridge connections and traffic operations under the preferred arterial bridge location.

2. DOCUMENTATION OF EXISTING CONDITIONS

This section summarizes existing conditions including information on the transportation network, land uses, and traffic operations.

2.1. Hayden Island Road Network

Vehicular access to Hayden Island is only possible via I-5 through the existing Hayden Island interchange. The street network on Hayden Island is illustrated in **Figure 1**.

The existing interchange is of an obsolete design. The southbound ramps terminate at a signalized intersection on the west side of I-5 at North Center Avenue opposite one of the principal entrances to the Jantzen Beach SuperCenter. The northbound ramps terminate on the east side of I-5 at a signalized intersection with North South Hayden Island Drive and North Tomahawk Island Drive.

There are three major public roads on the island: North Hayden Island Drive, North Tomahawk Island Drive, and North Center Avenue. The majority of streets on Hayden Island are privately owned and maintained. Some of the private roads are accessible to the general public; others are reserved for the residents who live in the gated communities to which the roads provide access.

Most Hayden Island roads, both public and private, are classified by the City of Portland as local service streets for all five classification categories: Traffic, Transit, Freight, Pedestrian, and Bicycle.

The City of Portland has higher designations for major streets and specific sections of major streets on Hayden Island. North Center Avenue is designated as a District Collector, a Community Transit Street, and a City Walkway. The city classifies most sections of North Hayden Island Drive as a District Collector and a Major Truck Street. North Jantzen Drive and North Tomahawk Island Drive function as Neighborhood Collectors and City Walkways.

On Hayden Island, the most common posted speed is 25 miles per hour including all the streets designated as collector streets. Private roads in both sections of the manufactured home park and the internal circulation roads through the Jantzen Beach SuperCenter are posted at 10 and 15 miles per hour, respectively. There are a few locations where there is no speed limit posted.

Most streets have two travel lanes, although North Center Avenue has a four-lane cross-section for some of its length. North Hayden Island Drive has a center turn lane for part of its length, but otherwise this feature is not present on any other street.

Public streets and those adjacent to the interchange generally have lanes meeting the standard width of 12 feet. Private streets generally feature narrower lanes.

Many of the residential and business streets allow on-street parking. Roadways near the interchange generally do not allow on-street parking or restrict it to one side of the street.

The existence and attributes of sidewalks vary considerably. They range from sidewalks on both sides of the street to sidewalks on one side to a complete absence of facilities for pedestrians. Width varies from a standard five-foot width to two-foot wide sidewalks. No streets on Hayden Island have marked on-street bike lanes. Pedestrian and bicycle routes on the island are circuitous, requiring substantial out-of-direction travel for these modes.

Appendix A presents more detailed information about the existing Hayden Island street network including their jurisdiction, street classification, posted speed, and key physical features.

2.2. Hayden Island Development and Land Use

Hayden Island encompasses about 1,450 acres with vastly different levels of development. Hayden Island is bisected by the Burlington Northern Santa Fe Railway (BNSF) line that parallels I-5 to the west. The rail line is used as the delineator between "west" and "east" Hayden Island.

The west side of Hayden Island (825 acres) is currently undeveloped and is owned by the Port of Portland. West Hayden Island lies within Portland's urban growth boundary. Though West Hayden Island is under Multnomah County's jurisdiction, planning functions are administered by the City of Portland under a complex intergovernmental agreement.

East Hayden Island (638 acres) is within the City of Portland and is developed with a mix of residential, retail, commercial, and industrial uses. Residential uses include a manufactured home park, houseboats, floating home moorages, single family homes, and condominiums. Commercial uses on east Hayden Island are primarily auto-oriented. They include the Jantzen Beach SuperCenter mall, "big box" retailers, hotels, restaurants, gas stations, and a grocery store. Industrial development includes auto wholesalers, manufacturing, and marine-related businesses.

Several parcels are currently vacant and various redevelopment proposals are being actively pursued or considered by property owners. For example, the Jantzen Beach SuperCenter is proposing a remodeling project, and there was interest in building a new, big box store on the site of the closed Thunderbird Hotel. The potential impact of development and redevelopment is discussed in further detail in subsequent sections of this report.

2.3. Hayden Island Vehicle-Trip Generation

A variety of unique factors shape transportation to, from and within Hayden Island. First and foremost, Hayden Island is unusual because I-5 provides the only vehicular access to the island. In addition, I-5 experiences over seven hours of level of service (LOS) 'F' congestion during weekdays in the vicinity of the Hayden Island interchange, making it difficult for motorists to access the island during these times.

The Institute of Transportation Engineers' (ITE) publication, *Trip Generation, 7th Edition,* is the standard reference for the trip generation characteristics of a wide variety of land uses. Based on thousands of studies conducted across the country, *Trip Generation* provides vehicle-trip generation rates for scores of uses (e.g., residences, retail stores, schools, industrial uses) using a variety of independent variables (e.g. housing units, square feet, students, employees). Using the procedures and methodology in *Trip Generation,* vehicle-trip generation estimates were prepared for Hayden Island's existing land uses. The initial estimates applied ITE's trip generation rates to each existing occupied land use. The results of the initial estimates, when applied to the I-5 ramps, were significantly higher than the I-5 ramp volumes for both the weekday PM and weekend midday time periods. In other words, the existing developments on Hayden Island produce and attract far fewer vehicle-trips than the averages observed from across the country. Previous work completed for the *Traffic Access, Traffic Circulation, and HCT Station Location Special Technical Study* for PDOT identified three factors affecting the number of trips produced by and attracted to Hayden Island.

The three factors identified include: 1) an accessibility factor; 2) an internal trip factor; and 3) a transit mode split factor. The accessibility factor takes into account the difficulty of accessing and leaving

Hayden Island during heavily congested times, such as weekday afternoons or midday during the weekends, and the absence of alternative route choices. The internal trip factor is used to account for the percentage of generated trips that are internal to the island, i.e., vehicle trips from one point to another on Hayden Island that do not use I-5. Finally, the transit mode split accounts for the existing number of bus riders during the peak periods.

Because the I-5 ramps provide the only access to the island and the ramp volumes are known, the initial trip generation estimates using standard rates from *Trip Generation* may be adjusted or calibrated to account for Hayden Island's unique characteristics using the three factors identified above.

The accessibility factor represents the percentage of traffic generated by a particular development relative to the national averages for that same type of development. An accessibility factor of 0.85, for example, means that the subject development produces only 85 percent of the trips predicted by applying the national averages.

Hayden Island's accessibility factors differ by time of day and by day of week in response to the varying levels of congestion on I-5 and at the interchange. Due to recurring weekday congestion along I-5 at and near its ramps, Hayden Island's accessibility factor is lower for the weekday PM peak hour than for the Saturday midday peak hour. From calibration modeling conducted during previous work, the overall accessibility factor for the weekday PM hour was found to be 0.50 for retail trips and 0.65 for all other land uses on the island. For the weekday midday peak, the overall accessibility factor was determined to be 0.70 for retail trips and 0.85 for non-retail trips.

It should be noted that these accessibility factors apply to the total of all retail and non-retail uses. Individual developments may have higher or lower factors, but the combined uses average the factors discussed above.

Similar to the accessibility factor, the internal trip factor varies according to the level of congestion on I-5, with different values by time of day and day of week. During periods of high congestion, motorists are more likely to make additional linked trips by successively visiting on-island destinations. Based on ITE methods completed for the special technical study, it was estimated that on average about 35 percent of the island's weekday PM peak hour trips are internal to the island and about 25 percent of the Saturday peak period trips are internal.

Based on bus ridership data provided by TriMet in 2006, it was determined that during the weekday PM period transit mode split is four percent of island traffic; during the weekend midday, the transit mode split is 2.5 percent. In other words, motor vehicle trips account for 96 percent of the weekday peak traffic and 97.5 percent of the weekend midday traffic.

By applying these three factors (accessibility, internal trips, and transit mode split) to the existing land uses on Hayden Island, the estimated vehicle-trip generation results closely matched the I-5 ramp counts at the interchange, thus accounting for the characteristics of development on Hayden Island and the transportation system serving it. **Table 1** shows a comparison between the estimated vehicle-trips and the actual I-5 ramp counts.

Table 1. Comparison of Factored Trip Generation vs. Actual Ramp Counts

	Weekday PM Peak Hour			Weekend MD Peak Hour		
	In	**Out**	**Total**	**In**	**Out**	**Total**
Estimated Vehicle-trips	1,086	1,232	2,318	2,110	1,954	4,065
Actual Trips	1,085	1,295	2,380	2,040	1,960	4,000
% Difference	**0.1%**	**-4.9%**	**-2.6%**	**3.5%**	**-0.3%**	**1.6%**

Source: *David Evans and Associates, Parisi Associates*

These factors can be used to help predict the transportation impacts of new development and redevelopment of Hayden Island, as well as and the implications of changes in the transportation system, including the CRC project.

2.4. Existing Hayden Island Traffic Conditions

Previous analyses completed for PDOT summarized in the *Existing Conditions Report for Hayden Island* have identified the following traffic issues related to Hayden Island:

- Severe congestion (level of service 'F') on the I-5 mainline for at least three hours in the southbound direction during the AM peak hours (6 AM to 9 AM);
- Severe congestion (level of service 'F') on the I-5 mainline for at least four hours in the northbound direction during the PM peak hours (3 PM to 7 PM); and
- Vehicle queues that extend to the upstream intersection at several of the closely spaced intersections near the Hayden Island interchange during the weekday midday peak hours, the weekend midday peak hours, and the PM peak hours. The length of these queues degrades the performance of the upstream intersections and significantly reduces the operations of the entire interchange area's street network.

3. COMPARISON OF EXISTING, MATURE EXISTING AND CONCEPT PLAN LAND USE SCENARIOS

This section provides a comparison of the existing development on Hayden Island with two possible future scenarios: the Mature Existing scenario and the Concept Plan scenario.

3.1. Overview of the Scenarios

Existing land uses and the current transportation network were described in the previous section. The Mature Existing scenario was developed as part of the *Traffic Access, Traffic Circulation and HCT Station Location Special Technical Study*, which examined the transportation impacts of potential land uses in the 2030 time period. The Concept Plan scenario was developed through a collaborative planning process which involved the City of Portland Bureau of Planning, several consultant teams which focused on transportation, architecture, public outreach and other areas of expertise, and the input of the local community and businesses on Hayden Island.

The Mature Existing scenario would feature a higher level of development on Hayden Island. The Concept Plan would see a significant increase in the number of housing units, a 40 percent decrease in overall retail square footage, and little to no change in other land uses. The alternative future scenarios reflect the potential for development and redevelopment and the expectation that the transportation system will be enhanced by the Columbia River Crossing project, which is discussed in greater detail in the next section. Both scenarios take into account the zoning restrictions on residential development on land affected by the noise contour created by flights to and from Portland International Airport.

Table 2 provides an overview of the development levels on Hayden Island using broad categories of land uses. It directly compares the existing, mature existing and concept plans scenarios. The explanation of the two future scenarios follows the table.

Table 2. Comparison of Existing Land Use and 2030 Land Use Scenarios for Hayden Island

Land Use	Units	Existing	Mature Existing	Concept Plan
Retail	Sq. Ft.	1,000,000	1,800,000	600,000
Hotel	Rooms	600	600	600
Industrial	Sq. Ft.	750,000	1,250,000	675,000
Office	Sq. Ft.	50,000	60,000	50,000
Housing	Units	1,300	1,600	3,100
Marina	Berths	2,200	2,200	2,200

Source: *Traffic Access, Traffic Circulation and HCT Station Location Special Technical Study*

3.2. Mature Existing Scenario

The Mature Existing scenario assumes that existing zoning designations will be retained and that future development will mostly mirror current land uses and recent development trends.

This scenario assumes most growth on Hayden Island would be big box or shopping mall-type retail concentrated in the commercially zoned land near the I-5 interchange. As shown in **Table 2**, the Mature Existing scenario represents a future with substantially more retail and industrial uses than exist today, but with little change in housing or other land uses.

Although Portland's "CG" zoning allows a variety of uses, retail was assumed because it represents current land use patterns. It was assumed that retail buildings would be single story and parking would be in surface lots. In addition, new industrial development would be added to vacant and underutilized parcels in areas with "IG" zoning. Residential uses would be the same as today with the addition of two new condominium developments that have been proposed. These general growth projections for the eastern portion of the island were created by the City of Portland.

Development assumptions for West Hayden Island were based on the Port of Portland's *West Hayden Island Transportation Analysis* study. The development scenario used for the Hayden Concept Plan study was based on the Port's 'Build-out, Option 2.' This option assumed: a 270-acre automobile distribution facility, an intermodal rail yard, and a bulk terminal employing 45 people.

The Mature Existing scenario was evaluated to determine its potential vehicle-trip generation and effects on traffic capacity at the Hayden Island/I-5 interchange. The impact of this increased level of development would greatly increase the number of trips going to and from the island. Without transportation system improvements, the Mature Existing scenario would exacerbate existing transportation problems. Even with the proposed improvements to the Hayden Island interchange area with the Columbia River Crossing (CRC) project, including a high capacity transit station and local street improvements, the Mature Existing scenario would produce over 30 percent more traffic than the system could accommodate. The full results of the transportation impacts of the Mature Existing scenario may be found in the *Traffic Access, Traffic Circulation and HCT Station Location Special Technical Study.*

3.3. Concept Plan Scenario

The Hayden Island Concept Plan scenario represents a significantly different future for Hayden Island. As illustrated in **Table 2**, the Concept Plan scenario assumes significantly greater residential development than either the Existing or Mature Existing Scenarios and less retail and industrial use.

The Concept Plan scenario seeks to replace the existing mix of land uses with a new mix that moves toward a balance of residences, employment, and shopping that take advantage of and reinforce the presence of each other. The Concept Plan scenario is also designed to take advantage of the Columbia River Crossing's planned high capacity transit corridor with a transit station on Hayden Island.

Structurally, the Concept Plan is designed to feature an interconnected pedestrian-oriented circulation network and land use pattern that supports community-building and increases transit ridership. The proposed transit station, street system, and greenways would link land uses and take advantage of the site's proximity to the Columbia River and North Portland Harbor. Commercial development on the island is envisioned to be a mixture of "lifestyle" retail similar to Bridgeport Village near Tualatin, Oregon, with local retail and some conventional large-format commercial development. Parking is anticipated to be provided through a mix of surface lots and structured parking facilities.

A grid street network aims to avoid most existing buildings so that redevelopment could be implemented in phases. A grid street network would also seek to avoid concentrating traffic on wide streets that inhibit pedestrian activity between adjacent uses and to and from the transit station.

The development of West Hayden Island under the Concept Plan scenario is identical to that assumed for the Mature Existing scenario. Both use a combination of industrial uses planned by the Port of Portland.

The transportation impacts of the Concept Plan are detailed in the next section.

4. DOCUMENTATION OF CONCEPT PLAN SCENARIO

This section summarizes information on the transportation network, travel demand model development, and traffic operations for the Concept Plan scenario.

4.1. Transportation System for Concept Plan

4.1.1. Future Transportation System Assumptions

The Hayden Island Concept Plan traffic analysis is based on the assumption that the Columbia River Crossing replacement bridge alternative will have been constructed along with a new high capacity transit corridor. Further explanation of the Columbia River Crossing and other key transportation elements are discussed below.

4.1.2. Interchange Features

A key element of the Columbia River Crossing project is the rebuilding of the I-5 Hayden Island interchange as a split Single Point Urban Interchange (SPUI). The design of the new Hayden Island interchange would split the I-5 ramp terminals between the north and south end of the island, one located on North Hayden Island Drive and the other on North Jantzen Drive. The on- and off-ramps would have two lanes each at their terminals with dual left-turn lanes for vehicles entering and exiting the on- and off-ramps.

The new interchange would have a smaller footprint than the existing one, allowing development to occur in the right-of-way currently occupied by curvilinear ramps and adjacent streets. The new interchange is assumed to provide direct access ramps that allow vehicles to travel between Hayden Island and Marine Drive, in both directions, without vehicles being required to enter and exit the I-5 mainline.

The anticipated configuration of the interchange would provide for three east-west connections beneath I-5: North Hayden Island Drive at the north; North Jantzen Avenue at the south; and North Tomahawk Island Drive in the middle. Besides allowing connections between the east and west sides of the island, North Hayden Island Drive would provide the connections to southbound I-5 and from northbound I-5. North Jantzen Avenue would provide the connections to northbound I-5 and from southbound I-5. North Tomahawk Island Drive would not connect directly with I-5, but would connect the east and west side of the island for motorists, bicyclists, and pedestrians.

A key feature of the interchange is the use of ramp meters to control traffic flow onto the I-5 mainline in both directions. The ramp meters are anticipated to be active only during the peak periods in the direction of peak traffic flow on I-5. For example, the northbound on-ramp would only operate during the weekday PM peak period. The ramp meters are planned to operate at a maximum rate of 1,400 vehicles per hour. It is assumed that neither ramp meter would be operational during the weekend midday peak period, as traffic volumes on I-5 are low enough to not merit metering on-ramp traffic flows.

4.1.3. Local Road Network

The details of the future local road network on Hayden Island were determined based on the results of this traffic analysis. General guidance from both the Hayden Island planning process and the Columbia River Crossing project serves as a starting point. A map of the street network can be seen in **Figure 2**.

The planned Hayden Island street network seeks to reinforce the existing street network by introducing additional streets in a grid pattern, particularly on the west side of I-5,. The new streets suggested to

reinforce the grid pattern are depicted in **Figure 2** and have been assigned placeholder names: North Sunrise Avenue, North Main Street, North Sunset Avenue and North Jules Verne.

North Hayden Island Drive, North Main Street, and North Jantzen Drive are predicted to carry the highest volumes of traffic on the island. They would form a five-lane cross-section ring road that surrounds the highway interchange. Major intersections with these five-lane roads would be signalized.

Oregon Department of Transportation (ODOT) access control requirements limit the spacing of interchanges and restrict some of the movements in close proximity to interchange ramp terminals. In general, ODOT requires ¼ mile spacing between an interchange ramp terminal and the nearest full-movement signalized intersection and restricts closer intersections to right-in, right-out movements. For example, ODOT would likely require the intersection of North Jantzen Avenue and North Sunrise Avenue to be right-in, right-out configuration, if an intersection would be allowed at that location.

The remaining roadways on the island are assumed to have either two or three lanes depending upon driveway and intersection spacing and whether vehicle turning volumes are high. Separate left-turns lanes would be provided where moderate to high turn volumes are expected. As indicated above, most intersections with North Hayden Island Drive, North Jantzen Drive and North Main Street would be expected to be signalized; the remaining intersections on the island are proposed to be stop sign-controlled. These decisions will be determined later in the process in consultation between the City of Portland and ODOT.

Many design details, such as the presence or absence of on-street parking and intersection spacing, remain to be decided based on further study including information on the adjacent land uses, building placement, and design requirements.

4.1.4. High Capacity Transit

The Columbia River Crossing project would also provide new high capacity transit service to Hayden Island. Two options for providing high capacity transit are still under consideration at this time. Both options are predicted to substantially increase the use of public transit on Hayden Island relative to existing conditions. The first option would extend the existing light rail transit MAX Yellow Line north from the Expo Center to Hayden Island, then over the Columbia River to Vancouver, Washington. The second option would be to provide a Bus Rapid Transit between the Expo Center, Hayden Island and Vancouver. The Columbia River Crossing preferred option will be chosen and identified as the Locally Preferred Alternative (LPA) during the summer of 2008. It is noted that the Hayden Island Concept Plan and the City of Portland's preferred option for high capacity transit is light rail transit, with the alignment immediately adjacent to the west side of I-5.

4.1.5. High Capacity Transit Station Location

Several factors are germane to the location of the high capacity transit station on Hayden Island. Key factors considered include: 1) the need to meet ODOT access control requirements for the roads intersecting the ramp terminals for the new interchange; 2) the location of existing roadways; 3) the desire to provide lot sizes that would be conducive to appropriate development adjacent to the station; and 4) the need for the high capacity transit facility to match the elevation of the new I-5 bridge or be part of the new bridge while avoiding excessive grades.

Based on these constraints, the Hayden Island Concept Plan assumes that the high capacity transit station on Hayden Island would be located west of and adjacent to I-5. This location creates lots and land use

patterns conducive to the types of development envisioned in the Concept Plan. The station is assumed to be elevated above the surrounding area because this would eliminate at-grade crossings, allow easier grades for the high capacity transit vehicles, and provide the best opportunity for an east-west circulation road from one side of I-5 to the other that is independent of the I-5 ramp.

4.1.6. Facilities for Non-Motorized Travel

Another element of the planned Columbia River Crossing project is a substantially improved transportation system for pedestrians and bicyclists. To enhance the system for pedestrians and bicyclists, the Columbia River Crossing project will include a new, modern facility adjacent to the high capacity transit alignment along the entire corridor from Marine Drive to Vancouver. This facility would include improved connections to the local and regional pedestrian and bicycle networks at Marine Drive, Hayden Island, downtown Vancouver, and other locations.

Multiple connections between Hayden Island and the non-motorized system for the Columbia River Crossing project are anticipated. Facilities will comply with the provisions of the Americans with Disabilities Act (ADA), and the emphasis will be on creating inviting, easy-to-use facilities that promote these alternatives and integrate with the high capacity transit system. Details will be further developed with the selection of the LPA for the Columbia River Crossing project and the subsequent design phase.

The network of facilities for non-motorized travel on Hayden Island is envisioned to include sidewalks on all streets and an interconnected multi-use pathway system integrating parks and public spaces. Details of the pathway system will be more fully developed in subsequent studies as the planning and design processes are further refined and development occurs.

4.2. Concept Plan Travel Demand Model Development

Due to the extent of the redevelopment and the importance of protecting the function of the proposed interchange and the capacity of the I-5 mainline, a systematic approach was employed to evaluate the Concept Plan scenarios for transportation needs.

The evaluation employed the traditional four-step process for transportation analysis: trip generation, trip distribution, mode split, and traffic assignment. The predicted traffic volumes were used to assess traffic operations and features needed to accommodate traffic, including the type of traffic control and number of lanes for key roadways. The analysis culminated with recommendations for the street network and suggestions for additional analyses as more detailed development plans become available.

4.2.1. Trip Generation

SERA Architects developed the land use assumptions for the Concept Plan. Transportation analysis zones were developed as shown in **Figure 3**. Based on input from the community design workshops and working within the overall planning context, SERA proposed land uses for each subarea, using categories from ITE's *Trip Generation, 7th Edition.* For each particular land use, the level of development was calculated with specific details such as the number of units of residential, square feet of retail, or acres of park.

The nature of the vast majority of retail land uses on Hayden most resembles that of a large shopping center, as defined by *Trip Generation.* There are several reasons for this: most of the retail properties are located adjacent to each other on the west side of I-5; access to all properties can only arise from the I-5 interchange; the geography of Hayden Island naturally captures internal trips; and the congestion on I-5 in

combination with many complementary businesses creates an environment of pass-through trips and trip-chaining shopping journeys. Thus, using total gross square footage as the independent variable, the number of trips generated by the shopping center was calculated. A few individual high trip-generation retail establishments were calculated individually and then added to the new retail trip generation.

A similar procedure was used for all light industrial properties. A trip generation rate, based on square footage, was used to estimate the number of aggregate trips produced for all light industrial properties. Trips were then assigned to each individual property based on its percentage contribution to the total gross square footage.

Trip generation for residential land uses was based upon the number and type (e.g., single-family, apartment, manufactured homes) of units of housing. Hotel trip generation was based on the total number of rooms each property contained. Trips generated by marinas were based upon the number of berths in each marina. Trip generation for parks was determined by the number of acres of parkland. Development assumptions for West Hayden Island in the Concept Plan were exactly the same as for the previously described Mature Existing scenario.

Table 3 summarizes the trip generation of the Concept Plan development scenario for the two time periods used in the transportation analysis. Detailed information on trip generation by subarea is included in **Appendix B**. **Table 3** presents the unadjusted trip generation predicted by application of the standard trip generation rates from ITE's *Trip Generation* from the national averages. Explanation of the application of adjustments is in the next section.

Table 3. Trip Generation for Hayden Island Concept Plan (Unadjusted Vehicle Trips)

	Weekday PM			Weekend Midday		
Area	**In**	**Out**	**Total**	**In**	**Out**	**Total**
West Hayden Island	63	93	156	128	152	280
East Hayden Island, west of I-5	1,809	2,074	3,883	2,035	1,719	3,754
East Hayden Island, east of I-5	1,593	1,387	2,980	1,720	1,540	3,260
Total Trips	**3,465**	**3,554**	**7,019**	**3,883**	**3,411**	**7,294**

Source: *David Evans and Associates, Parisi Associates*

4.2.2. Application of Adjustment Factors

Similar to the trip generation for the existing conditions analysis, the Concept Plan development scenario requires the same three adjustment factors for accessibility, internal trips, and transit mode split. **Table 4** shows the accessibility factors, internal trip factors, and transit mode percentages for both the weekday PM and midday weekend peak periods for Existing Conditions and the Concept Plan. The factors in **Table 4** were used to adjust the trip generation predicted in **Table 3**.

Table 4. Trip Generation Adjustment Factors for Existing Land Use and Concept Plan

	Weekday PM		Weekend Midday	
Factor	**Existing**	**Concept Plan**	**Existing**	**Concept Plan**
Accessibility				
Retail	50.0%	75.0%	70.0%	85.0%
Non-Retail	65.0%	82.5%	85.0%	92.5%
Internal Capture	35.0%	25.0%	25.0%	20.0%
Mode Split				
Inbound	4.0%	10.6%	2.5%	8.5%
Outbound	4.0%	5.8%	2.5%	4.6%

Source: *Traffic Access, Traffic Circulation and HCT Station Location Special Technical Study, David Evans and Associates, Parisi Associates*

Based on the expectation that the Columbia River Crossing project would significantly improve the I-5 mainline congestion problem and that the interchange would have substantially increased capacity, the accessibility factor is assumed to increase for Hayden Island in the Concept Plan. The internal trip factor is similarly expected to decrease due to the increased mobility resulting from the CRC project and the increase in mixed-use development. Both the accessibility and internal trips factors for the Concept Plan have been increased to a level that is halfway between existing conditions and 100 percent.

The public transit mode split on Hayden Island is expected to increase dramatically for the Concept Plan scenario with the construction of a high capacity transit station and the proposed transit-supportive land use mix. Either light rail transit or bus rapid transit service would substantially increase the attractiveness and use of public transit in the I-5 corridor and on Hayden Island. Consistent with TriMet's methodology for forecasting ridership, weekend mode split is calculated to be about 80 percent of weekday ridership.

The traffic volumes at the on- and off-ramps at the Hayden Island interchange and number of internal trips are calculated after the accessibility factor, the internal capture factor, and the mode split factor are applied to the theoretical number of trips from the initial trip generation step. The adjusted volumes can be seen in **Table 5**.

Table 5. Trip Generation for Hayden Island Concept Plan (Adjusted Vehicle Trips)

	Weekday PM			Weekend Midday		
Trip Type	**In**	**Out**	**Total**	**In**	**Out**	**Total**
Hayden Island Internal Trips	-	-	1,400	-	-	1,300
Public Transit Trips to/from I-5	220	120	340	240	110	350
Vehicle trips to/from I-5	1,850	2,000	3,850	2,530	2,310	4,840
Total Trips			**5,590**			**6,490**

Source: *David Evans and Associates, Parisi Associates*

4.2.3. Traffic Assignment

A computer-based, regional transportation model[1] is employed for the traffic assignment step for regional traffic forecasting, but for the Hayden Island Concept Plan scenario, traffic assignment was done by hand. This trip assignment technique used similar methods to the regional model, but took full advantage of the trip generation predicted from each subarea and a system of individual streets including local streets not included in the regional model.

The traffic assignment process accounted for trips coming to and going from Hayden Island from I-5. Trips from the I-5 ramps were routed toward their destinations on the island. Likewise, the outbound trips produced in each subarea and destined for locations off the island were routed toward the respective on-ramps. Data on trip origins and destinations from the regional model were used to determine which on-ramps (northbound or southbound) would be used and in what proportions.

Traffic was manually assigned to the street network based on the assumption that motorists would choose the most direct route, minimizing travel time. Parking was assumed to be located close to building locations. Internal trips were assigned to the arterial and local streets, and not to the ramps, because internal trips were those that originated and terminated on the island.

Pedestrian and bicyclist activity was assigned to the majority of street network on Hayden Island in order to assess their impact on traffic operations at the signalized intersections. The number of pedestrians and bicyclists crossing streets in the Concept Plan ranged from 10 to 45 per hour, depending on location. The heaviest volumes of non-motorized traffic were assigned to North Tomahawk Island Drive and along North Main Street, which were expected to be the most attractive routes for walking and cycling.

4.3. Concept Plan Traffic Operations Analysis

Using the information described in the previous sections, the Concept Plan street network was evaluated using Synchro/SimTraffic, a computer software program that models traffic operations. These traffic analysis tools use the traffic volumes, lane configurations, and signal timing to assess the traffic operations and provide key indicators of performance including level of service, volume-to-capacity ratios, and the amount of queuing at intersections. Both signalized and unsignalized intersections were analyzed. **Figures 2** and **4** show the lane configurations and traffic control for each intersection.

The performance of the street network was evaluated for both the PM weekday peak hour and the midday weekend peak hour. The level of service is based upon the ranges defined in the Highway Capacity Manual and listed in **Table 6**. Intersection Capacity Utilization (ICU) and volume-to-capacity (V/C) are measurements of intersection capacity.

[1] Metro, the Metropolitan Planning Organization (MPO) for the Portland region, is responsible for the ownership, development and maintenance of the regional travel demand model used for travel forecasting in the Portland area.

Table 6. Intersections Level of Service Standards

Level of Service	Control Delay (seconds/vehicle) Signalized	Unsignalized
A	≤ 10	≤ 10
B	> 10 and ≤ 20	> 10 and ≤ 15
C	> 20 and ≤ 35	> 15 and ≤ 25
D	> 35 and ≤ 55	> 25 and ≤ 35
E	> 55 and ≤ 80	> 35 and ≤ 50
F	> 80	> 50

Source: *Highway Capacity Manual, 2000.*

The results of the Syncho/SimTraffic model for the Hayden Island intersections for the weekday PM peak hour are summarized in **Table 7**. The results for the weekend midday peak hour are summarized in **Table 8**. Both tables were based on full build-out of the Hayden Island Concept Plan and year 2030 traffic on I-5.

Table 7. Traffic Operations Results Summary
Weekday PM Peak Hour - Hayden Island Concept Plan - 2030

Intersection	Approach / Movement	Delay (Seconds)	LOS	ICU / V/C[1]
South Ramp Terminal - Center	***Overall Intersection***	17.4	B	0.44
South Ramp Terminal - East	***Overall Intersection***	16.1	B	0.21
South Ramp Terminal - West	***Overall Intersection***	3.6	A	0.27
Hayden Island Dr and Jantzen Dr	***Overall Intersection***	9.2	A	0.49
North Ramp Terminal - East	Northeast Right	2.5	A	0.63
North Ramp Terminal - Center	***Overall Intersection***	20.9	C	0.34
North Ramp Terminal - West	***Overall Intersection***	7.5	A	0.26
Hayden Island Dr and Sunrise	Northbound Right	5.9	A	0.12
Hayden Island Dr and Main	***Overall Intersection***	19.5	B	0.58
Hayden Island Dr and Sunset	Northbound Left/Thru/Right	8.4	A	0.22
Hayden Island Dr and South Shore Ave	Northbound Left/Right	5.8	A	0.17
Tomahawk Island Dr and Main	***Overall Intersection***	9.9	A	0.57
Tomahawk Island Dr and Sunrise	Westbound Left/Thru	7.4	A	0.32
Tomahawk Island Dr and Sunset	Northbound Left/Thru/Right	6.8	A	0.14
Tomahawk Island Dr and South Shore Ave	Westbound Left/Right	3.4	A	0.03
Jules Verne and Main	***Overall Intersection***	9.4	A	0.46
Jules Verne and Sunrise	Northbound Left/Thru	5.2	A	0.14
Jules Verne and Sunset	Northbound Left/Thru/Right	5.4	A	0.15
Jules Verne and South Shore Ave	Westbound Left/Right/Thru	3.9	A	0.04
Jantzen Ave and Main	***Overall Intersection***	6.9	A	0.36
Jantzen Ave and Sunset	Southbound Left/Right	7.1	A	0.10
Jantzen Ave and Sunrise	Southbound Right	5.4	A	0.02
Tomahawk Island Dr and Jantzen Dr	***Overall Intersection***	18.2	B	0.64

Note 1: *The ICU is used for signalized intersections. The V/C is used for the identified movement(s) at unsignalized intersections.*
Source: *David Evans and Associates, Parisi Associates*

Table 8. Traffic Operations Results Summary
Weekend Midday Peak Hour - Hayden Island Concept Plan – 2030

Intersection	Approach/Movement	Delay (Seconds)	LOS	ICU / V/C[1]
South Ramp Terminal - Center	***Overall Intersection***	17.9	B	0.46
South Ramp Terminal - East	***Overall Intersection***	13.6	B	0.28
South Ramp Terminal - West	***Overall Intersection***	3.0	A	0.33
Hayden Island Dr and Jantzen Dr	***Overall Intersection***	11.9	B	0.65
North Ramp Terminal - East	Westbound Thru	2.3	A	0.79
North Ramp Terminal - Center	***Overall Intersection***	19.7	B	0.46
North Ramp Terminal - West	***Overall Intersection***	4.6	A	0.27
Hayden Island Dr and Sunrise	Northbound Right	7.2	A	0.19
Hayden Island Dr and Main	***Overall Intersection***	16.3	B	0.59
Hayden Island Dr and Sunset	Northbound Left/Thru/Right	7.1	A	0.21
Hayden Island Dr and South Shore Ave	Northbound Left/Right	7.4	A	0.19
Tomahawk Island Dr and Main	***Overall Intersection***	11.9	B	0.49
Tomahawk Island Dr and Sunrise	Westbound Left/Thru	8.9	A	0.45
Tomahawk Island Dr and Sunset	Southbound Left/Thru/Right	6.0	A	0.17
Tomahawk Island Dr and South Shore Ave	Westbound Left/Right	4.6	A	0.10
Jules Verne and Main	***Overall Intersection***	9.5	A	0.41
Jules Verne and Sunrise	Northbound Left/Thru	5.8	A	0.24
Jules Verne and Sunset	Northbound Left/Thru/Right	5.1	A	0.16
Jules Verne and South Shore Ave	Westbound Left/Right/Thru	4.2	A	0.06
Jantzen Ave and Main	***Overall Intersection***	7.1	A	0.34
Jantzen Ave and Sunset	Southbound Left/Right	8.8	A	0.13
Jantzen Ave and Sunrise	Southbound Right	3.6	A	0.06
Tomahawk Island Dr and Jantzen Dr	***Overall Intersection***	26.3	C	0.76

Note 1: *The ICU is used for signalized intersections. The V/C is used for the identified movement(s) at unsignalized intersections.*
Source: *David Evans and Associates, Parisi Associates*

As indicated in **Tables 7** and **8**, all of the intersections are predicted to operate very well in the year 2030. The poorest LOS is predicted to be 'C', which meets the City of Portland's operational standard of LOS 'D'. The v/c ratios of the ramp terminal intersections are better than ODOT's maximum allowable v/c standard of 0.85 specified in the Oregon Highway Plan (OHP) for ramp terminals.

Figures 5 and **6** show the extent of the 95th percentile queues during the PM weekday and midday weekend peak periods, respectively. The 95th percentile vehicle queue represents the distance of which 95 percent of all queues will be shorter than or equal to. The 95th percentile queue is used to estimate whether storage lanes can adequately accommodate typical queue length variations during a peak traffic period without spilling over into adjacent travel lanes or into another intersection. Forecast traffic queues are relatively modest, and do not spill back into adjacent intersections. Queue storage should be easily accommodated during the design of the street network and intersections on Hayden Island. A complete list of 95th percentile queues for all movements at all study intersections may be viewed in **Appendix C.**

4.3.1. North Jantzen Drive Alignment

One of the issues that needed to be addressed during the evaluation of the Concept Plan was the proximity of planned street intersections on the east side of I-5 to access spacing with the ramp terminals of the new interchange. The issue arises because ODOT's access management spacing calls for the nearest full access intersection to be 1,320 feet from an interchange ramp terminal or to move in the direction of such spacing.

On the east side of I-5, the ODOT access management spacing standards could affect the alignment of North Jantzen Drive, which determines the distance between the ramp terminals and the nearest intersections. Two basic alignments were considered for North Jantzen Drive: the version preferred by the residents of Hayden Island and the City of Portland (shown in **Figure 2**) and a version that realigns North Jantzen Drive further east (shown in **Figure 4**).

The preferred alignment of North Jantzen Drive from the perspective of the Hayden Island community would provide a cluster of neighborhood commercial around the intersection of North Jantzen Drive and North Tomahawk Island Drive. Among other attributes, this configuration would allow residents of the far easterly portion of Hayden Island to access parts of this commercial area without crossing North Jantzen Drive.

The second alternative, which realigns North Jantzen Drive further to the east, would provide somewhat greater separation between the I-5 northbound off-ramp terminal and the intersection of North Hayden Island Drive and North Jantzen Drive. It would also increase the distance between the northbound ramp terminal and the intersection of North Tomahawk Island Drive and North Jantzen Drive. This change in configuration moves closer to the intersection spacing specified in ODOT's access management standard. In terms of land use and development, this easterly alignment for North Jantzen Drive would shift the planned neighborhood commercial areas to the "inside" of the ring road around the interchange. Most of the neighborhood commercial area would be accessible only by residents to the east by crossing North Jantzen Drive.

Traffic patterns are slightly different for the two versions of the North Jantzen Drive alignment. The Concept Plan's preferred alternative (shown in **Figure 2**) would result in slightly higher volumes of traffic on the easterly approach of North Tomahawk Island Drive and slightly lower volumes on the westerly approach at the intersection with North Jantzen Drive. The effect on traffic operations was determined to be minimal and would be confined to this single intersection.

Further analysis of the impacts of the access control that might be imposed by ODOT may be undertaken during development of the Interchange Area Management Plan.

5. HAYDEN ISLAND ARTERIAL BRIDGE

This section summarizes an evaluation of four proposed arterial bridge connections and their effect on traffic operations on Hayden Island.

5.1. Arterial Bridge Options

Alternative access from Hayden Island to the remainder of Portland has been under consideration for years. The general concept has been to provide an arterial roadway connection to Hayden Island supplementing the existing connection that currently depends upon and impacts I-5. As a result of discussions held during the community design workshops and the planning process for the Concept Plan, a new arterial bridge evaluation was conducted for Hayden Island.

Four arterial bridge options were considered, including a West Hayden Island Bridge location, about ½ mile west of the BNSF railroad line, that is specified in both the City of Portland's Transportation System Plan (TSP) and Metro's Regional Transportation Plan (RTP). The other three locations were: near the Portland Auto Auction about a mile west of I-5; along the North Force Avenue alignment about ½ mile west of I-5; and at Lotus Isle Park about ¾ mile east of I-5. The approximate locations of the arterial bridges evaluated in this study are illustrated in **Figure 7**.

All four bridge options were evaluated using the following criteria established by the City of Portland:

- Access to Portland street network
- Access to Hayden Island street network
- Impact to Hayden Island residents
- Impact on other community residents
- Access to potential Port of Portland facilities
- Impact to Marine Drive
- Impact to Expo Center
- Potential for joint development
- Pedestrian and bicycle facilities
- Island continuity
- Other

The full assessment matrix for the arterial bridge options studied by the City of Portland as part of planning process for the Concept Plan may be seen in **Appendix D**.

The Lotus Isle Park location suffers from many negative attributes. It would adversely affect residents on the east side of Hayden Island and in the Bridgeton neighborhood with truck traffic. In addition, houseboat moorage space on the south side of North Portland Harbor would be impacted. This option would be the least accessible to the Port of Portland facilities on Hayden Island and would not provide an opportunity for joint development with the Columbia River Crossing project. The option would disrupt island continuity and would eliminate the only existing park on Hayden Island. Based upon the ability of the Lotus Isle Park location to meet the assessment criteria, the City of Portland dismissed this alternative from further consideration.

The Portland Auto Auction alignment would adversely affect West Hayden Island Moorage houseboat residents and the residents of the Hayden Island Manufactured Home Park with truck traffic. Current land use does not provide an opportunity for access or construction of this option. Based upon the ability of the Portland Auto Auction location to meet the assessment criteria, the City of Portland dismissed this alternative from further consideration.

After surviving the initial assessment by the City of Portland, further analysis was conducted to address some of the engineering challenges associated with a potential bridge in the Force Avenue corridor. Many issues arise with the North Force Avenue corridor associated with providing appropriate clearances over the North Portland Harbor that separates Hayden Island from Portland. The North Portland Harbor is a navigation channel, which means the Coast Guard is ultimately the authority in regard to vertical clearance.

For the purposes of evaluating a possible bridge, it was assumed that clearances (35 to 40 feet depending on location) would match those planned for the Columbia River Crossing project for the I-5 mainline. Providing this clearance in the Force Avenue corridor would require raising the grade of the streets that would connect to the new bridge and those connecting with them. The elevation of Marine Drive and North Force Avenue would need to be raised by as much as 18 feet. Roadways on Hayden Island, including North Jantzen Avenue, would require similar elevation changes. Accommodating the elevation increase would require substantial land acquisitions, tall retaining walls, or a combination of both. Several driveways and some streets would need to be cut off or other access acquired. Other issues include changes to the levees along Marine Drive and relocation of the multi-use path on the south side of the North Portland Harbor. Based on these factors, the North Force Avenue corridor was dismissed from further consideration.

Ultimately, there was consensus by the participants in the Hayden Island Concept Plan process that the most appropriate location for a new arterial bridge, if one was to be provided, would be west of the BNSF alignment on West Hayden Island as specified in the both the Portland TSP and Metro RTP.

5.2. Concept Plan with West Hayden Island Bridge

As described in the previous section, the Portland TSP and Metro's RTP include the West Hayden Island Bridge as a connection between Hayden Island and Portland. The southern connection would terminate at Marine Drive, an important freight route in Portland, connecting I-5 with Port of Portland facilities located at Terminals 4, 5, and 6. Marine Drive also provides access to the Rivergate Industrial District west of I-5, and to the Columbia Corridor Industrial Area located on both the east and west sides of the highway. Marine Drive also provides access to 99E and NE MLK Jr. Boulevard, both freight routes into Portland.

The Columbia River Crossing project proposes to rebuild and reconfigure the Marine Drive interchange. The new interchange is proposed to be a modified SPUI, with the eastbound Marine Drive to northbound I-5 connection constructed as a flyover ramp. This movement would carry the heaviest traffic volumes of the PM peak period and cause significant congestion on Marine Drive. Marine Drive itself would be reconstructed, realigned slightly south from its current location, and be raised above the proposed high capacity transit alignment west of I-5. The design of the interchange has not been finalized and the City of Portland is working with the Columbia River Crossing project to study several alternative alignments at and near the interchange.

The potential impact of the West Hayden Island Bridge was evaluated in connection with the Hayden Island Concept Plan. The analysis focused on the PM peak period for the 2030 build-out period and sought to assess the impact of diverting traffic from the Hayden Island interchange and the impact of that diversion to Marine Drive and to the Marine Drive interchange.

It was assumed that most of the traffic generated from the Port of Portland marine terminal on West Hayden Island would use the new bridge for access and egress because the bridge would provide the fastest and most direct freight route. In addition, it was assumed that 10 percent of traffic on the island originating from or destined for the area west of the I-5 interchange would use the bridge based on vehicle-trip origin and destination patterns. Traffic east of I-5 was assumed to not use the bridge because of the additional travel time that would be incurred by drivers taking that route. The total amount of traffic using the bridge would be approximately 290 vehicles during the PM peak hour, with a fairly even split between inbound and outbound vehicles.

The net effect of the West Hayden Island Bridge would be a fairly minor reduction in traffic volumes at the Hayden Island interchange. This would cause a corresponding marginal improvement in level-of-service and volume-to-capacity ratio at the ramp terminals. In addition, there would be slightly less traffic on the local street network west of the I-5 interchange. However, there would be a very small increase in traffic volumes west along Hayden Island Drive towards the West Hayden Island Bridge and a very small increase in certain turning movements in the neighborhood. The slight increase in traffic volumes would occur along roads that carry little traffic. Therefore this would not have a significant affect on overall intersection performance.

During the weekday PM peak period in 2030, the northbound on-ramp to I-5 at Marine Drive would carry nearly 1,600 vehicles per hour. The West Hayden Island Bridge would increase this volume by approximately four percent. This increase in traffic would slightly increase delays at the ramp meter, extend the queue of vehicles on the on-ramp, and increase volume traveling east on Marine Drive to the interchange. Similar increases in volume would occur for other movements at the interchange. These increases would not significantly impact the traffic operations at the Marine Drive interchange because the increase in volume is quite small. If volumes were to grow to the point where there would be a larger increase in delay, it is likely that vehicles would divert back to using the Hayden Island interchange, until an equilibrium in travel time was reached between the two interchanges.

6. PRELIMINARY STREET CLASSIFICATION

In the TSP, the City of Portland describes the function of streets according to their function in seven different categories. **Table 9** (following page) summarizes a preliminary identification of the functional classification of Hayden Island's streets to meet the needs of the Concept Plan.

The street classification descriptions from the City of Portland describe the types of automobile, transit, bicycle, pedestrian, and truck use that should be emphasized on each street and how future street improvements and public and private development should relate to those uses.

In general, the street classification scheme assigns the ramp terminals and five-lane ring road a more intense level of usage. These roads also form the major truck and transit routes on Hayden Island. North Tomahawk Island Drive serves as the primary pedestrian and bicycle route connecting the east and west sides of the island. The majority of local streets west of the interchange are given the lowest level of classification, functioning as local service streets.

Table 9. Hayden Island Concept Plan Preliminary Street Classification

	City of Portland Street Classification				
Street	**Traffic**	**Transit**	**Freight**	**Bicycle**	**Pedestrian**
N. South Shore Ave	Local Service	Local Service	Local Service	Local Service	Local Service
N. Sunset Ave	Local Service	Local Service	Local Service	Local Service	Local Service
N. Main Street to N. Jantzen Drive	Neighborhood Collector	Minor City Transit Street	Major Truck Route	City Bikeway	City Walkway
N. Sunrise Ave	Local Service	Local Service	Local Service	Local Service	Local Service
N. Hayden Island Dr					
West Hayden Island to N. Main St	Neighborhood Collector	Local Service Street	Major Truck Route	City Bikeway	City Walkway
N. Main St to N. Jantzen Dr	Neighborhood Collector	Minor City Transit Street	Major Truck Route	City Bikeway	City Walkway
N. Jantzen Dr to N. Hayden Bay Dr	Local Service	Local Service	Local Service	Local Service	Local Service
N. Tomahawk Island Dr					
N. South Shore Ave to N. Main St	Local Service	Local Service	Local Service	City Bikeway	City Walkway
N. Main St to N. Jantzen Dr	Neighborhood Collector	Minor City Transit Street	Local Service	City Bikeway	City Walkway
N. Jantzen Dr to end	Local Service	Local Service	Local Service	City Bikeway	City Walkway
N. Jules Verne	Local Service	Local Service	Local Service	Local Service	Local Service

Source: *David Evans and Associates, Parisi Associates*

7. CONCLUSIONS

The goal of the Hayden Island Concept Plan is to create a vibrant, livable community on Hayden Island that promotes diverse land uses, is integrated with the natural environment, and has safe and reliable transportation options. The Concept Plan seeks to replace the existing land uses with a new mix that moves toward a balance of residences, employment, and shopping that take advantage of and reinforce the presence of each other. The Concept Plan is also specifically designed to take advantage of the existence of the Columbia River Crossing's planned high capacity transit corridor with a transit station on Hayden Island by including substantial increases in housing.

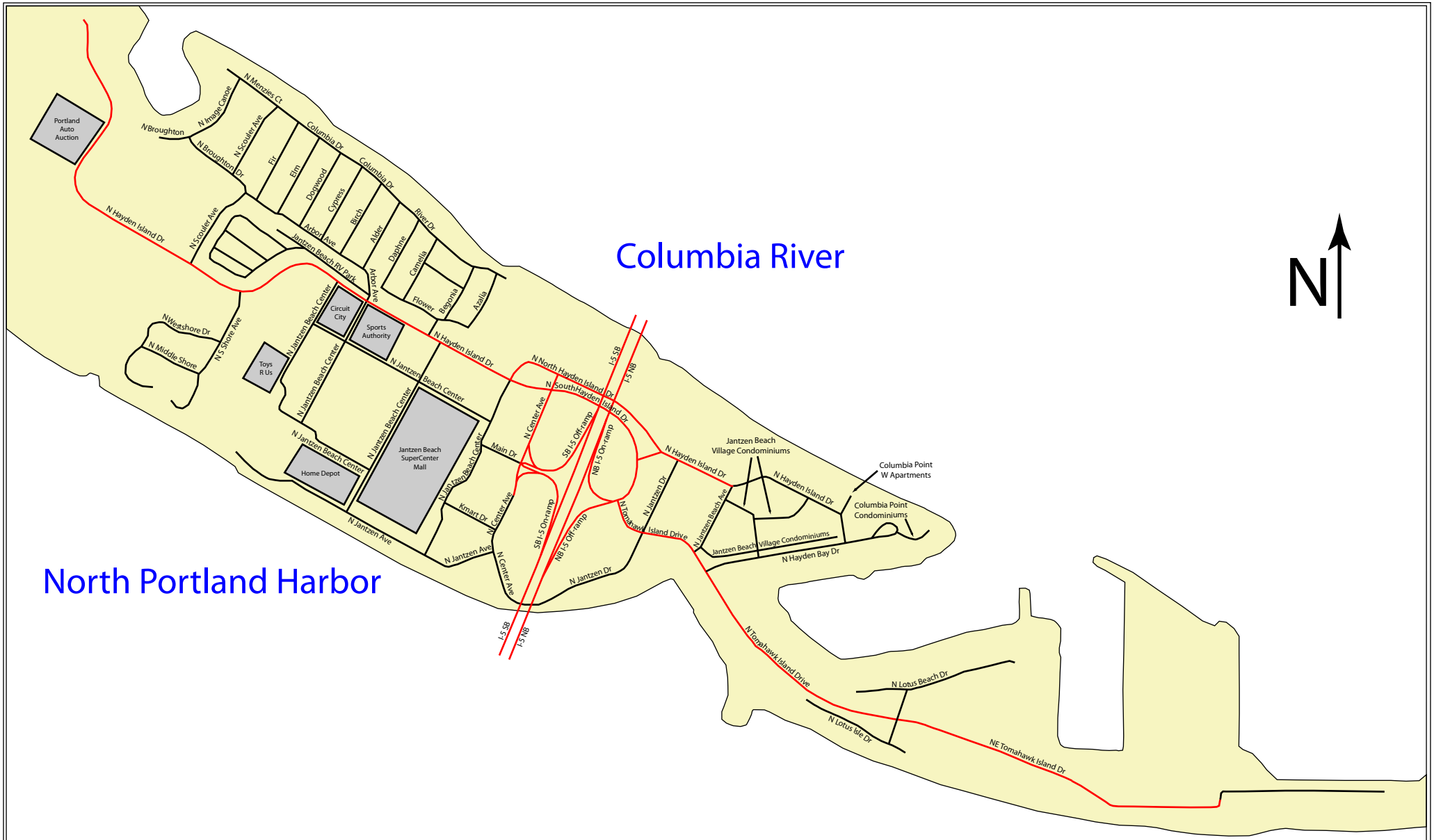
The Concept Plan scenario for Hayden Island was developed as a less auto-intensive alternative to the Mature Existing scenario, which would be a continuation of current land development trends. Unlike the Mature Existing scenario, which would provide for increased development consistent with current plan designation and zoning, the Concept Plan scenario could require some new designations and zoning changes.

The new Hayden Island interchange planned as part of the Columbia River Crossing replacement bridge alternative in combination with a reconfigured street network on Hayden Island, is calculated to solve existing deficiencies and operational problems and would provide additional capacity beyond what exists today. The estimated number of vehicle-trips generated with the Concept Plan's mixed-use scenario would be greater than the number of vehicle-trips on the island today, but could be accommodated by the proposed highway and local street infrastructure, especially with the presence of the high capacity transit corridor.

The street system proposed in connection with the Concept Plan seeks to develop a grid system that is more integrated with the proposed mixed-use concept. It also would serve non-auto users, including pedestrians and bicyclists and those accessing the planned transit station adjacent to the interchange. The street system proposed with the Concept Plan proposes a connection between the east and west sides of I-5 that does not intersect with the new interchange's ramp terminals.

The West Hayden Island Bridge, of the four bridge location studied, would provide the greatest benefit and access to Hayden Island residents, businesses and to a proposed Port of Portland marine development on West Hayden Island. This alternative would have the least impact on traffic patterns and existing land uses on Hayden Island and Marine Drive. The West Hayden Island Bridge would also provide opportunity for public agency cooperation on construction costs.

Specific elements of the Concept Plan deserve additional evaluation and study. Though the basic street network has been identified and the system has been shown to provide adequate capacity to meet operational needs and standards, design elements need additional consideration. Among these are the provision of on-street parking, center turn lanes, driveway spacing, and the degree of pedestrian emphasis. Many of these street elements will depend specifically on the adjacent land uses and will need to be determined when more is known about the developments and uses.



DAVID EVANS AND ASSOCIATES INC.

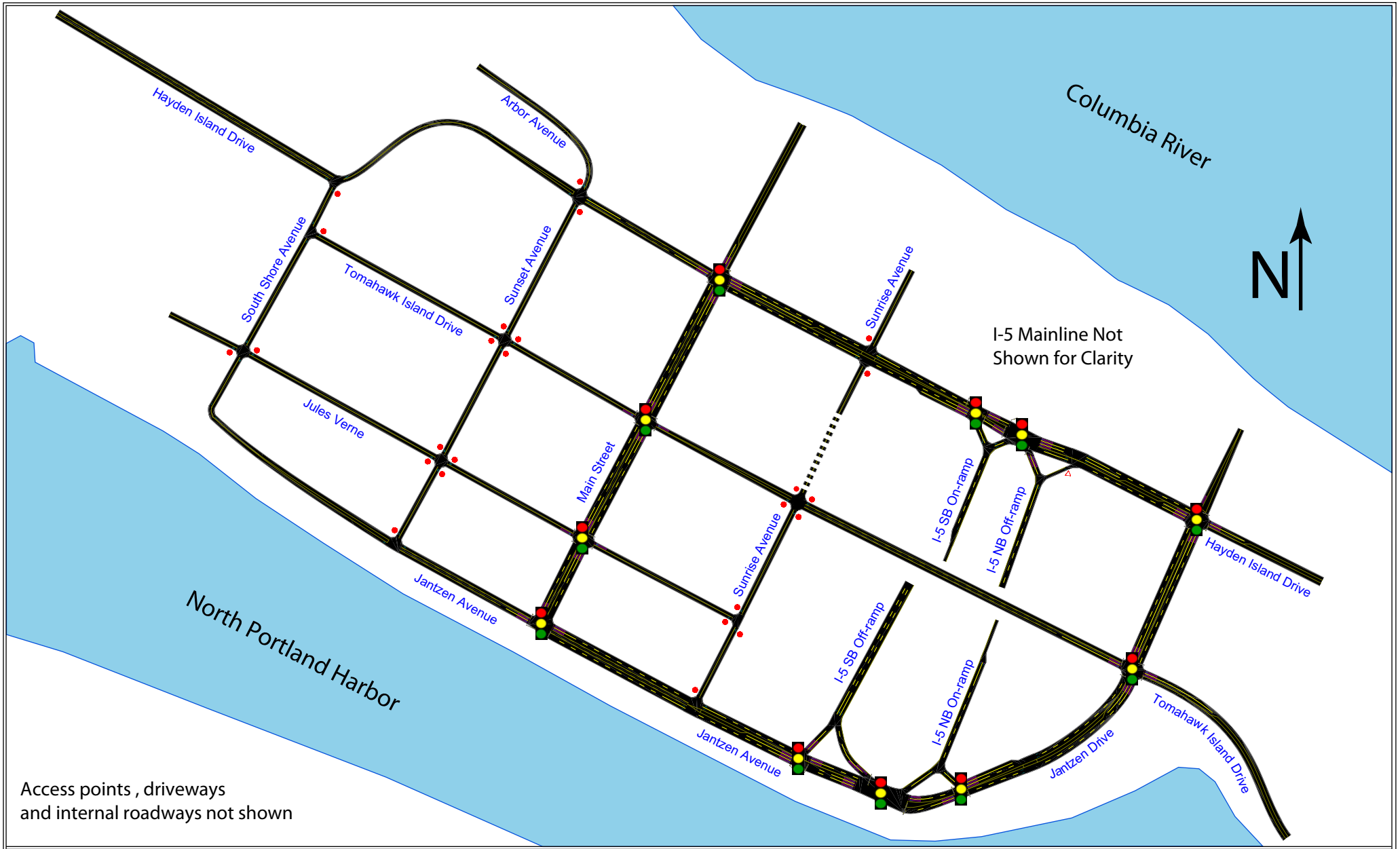
Parisi ASSOCIATES transportation consulting

Transportation Analysis for Hayden Island Concept Plan

Legend
- Public street
- Private street

Figure 1

Hayden Island Street Network - 2008



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Parisi ASSOCIATES transportation consulting

Transportation Analysis for Hayden Island Concept Plan

Legend
- Stop control
- Signal control
- Yield control
- Potential extension

Figure 2

Concept Plan
Street Network

Data Sources: City of Portland GIS, Metro RLIS
Not to scale

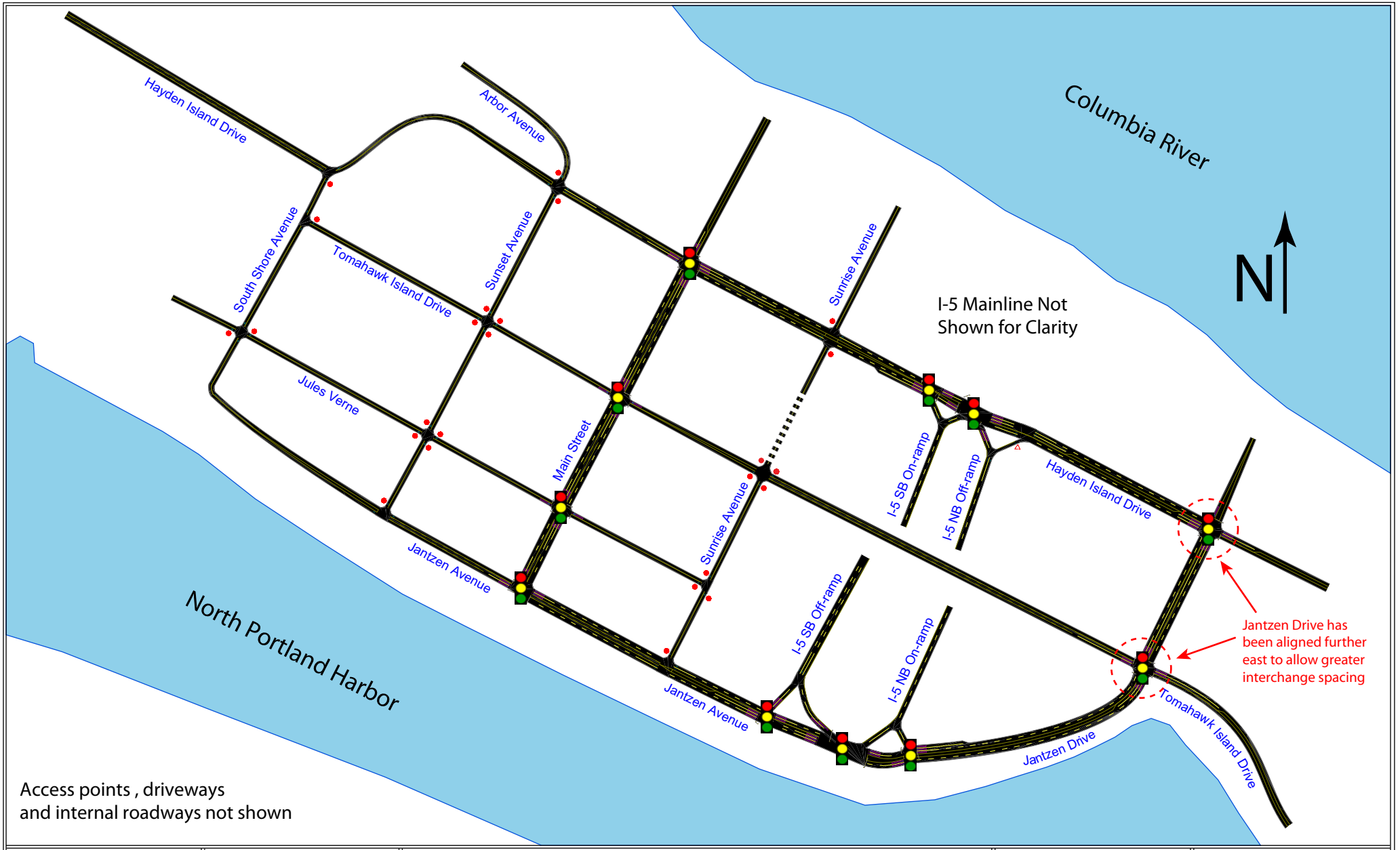
DAVID EVANS AND ASSOCIATES INC.

SERA

Transportation Analysis for Hayden Island Concept Plan

Parisi ASSOCIATES transportation consulting

Figure 3
Hayden Island Concept Plan Subarea Map



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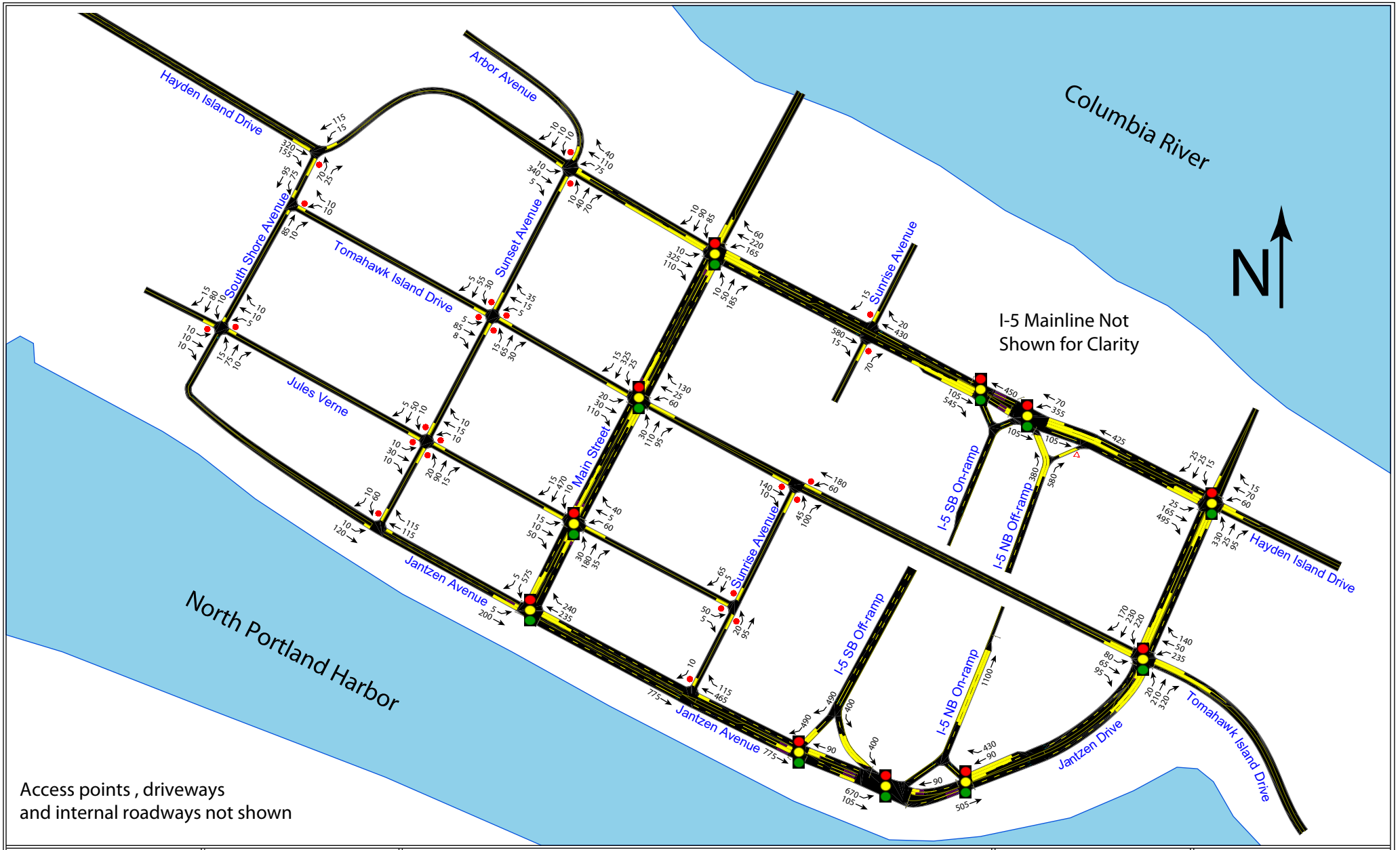
Parisi ASSOCIATES transportation consulting

Transportation Analysis for Hayden Island Concept Plan

Legend
- Stop control
- Signal control
- Yield control
- Potential extension

Figure 4

Jantzen Drive
Eastern Alignment



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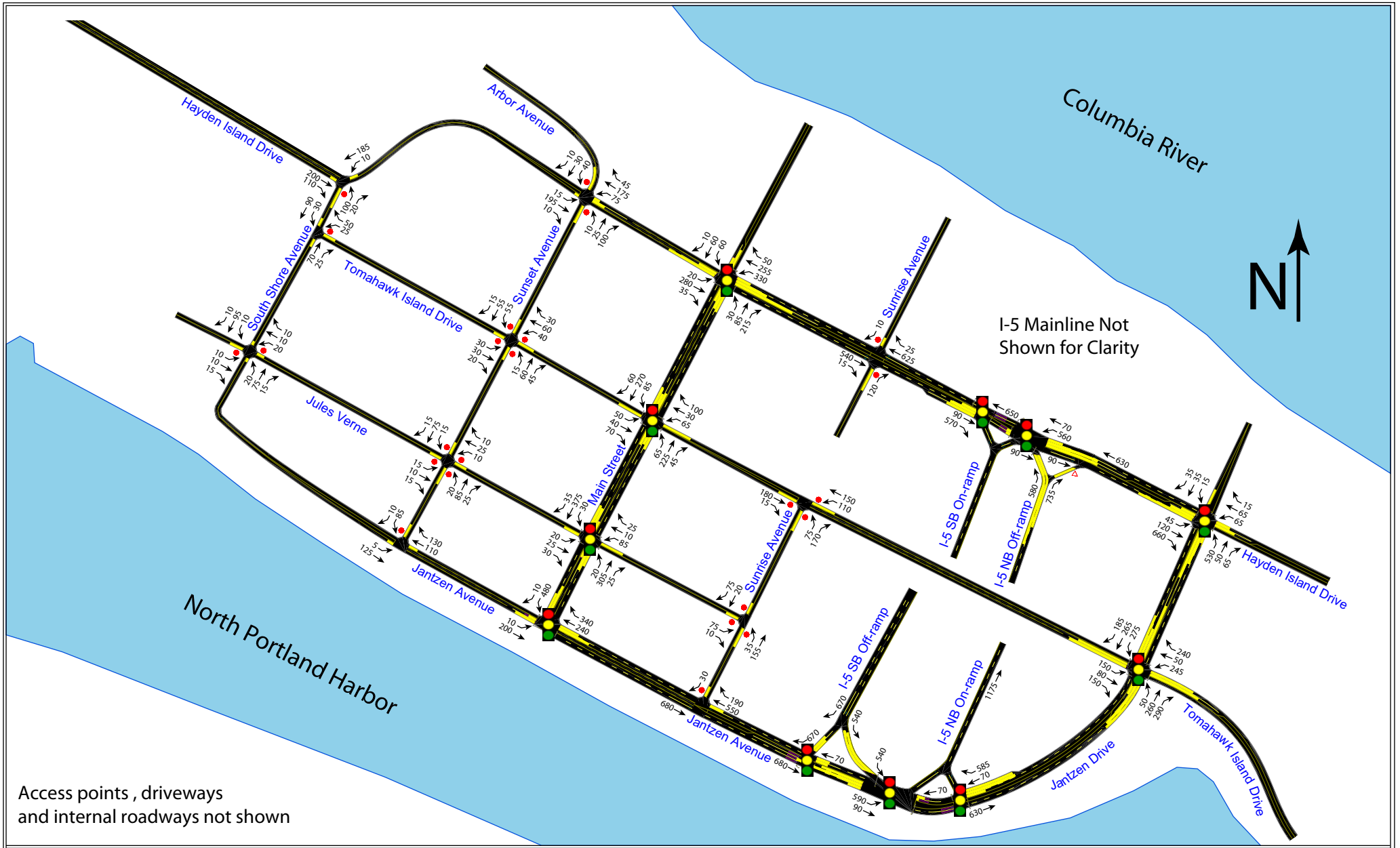
Transportation Analysis for Hayden Island Concept Plan

Legend
- Stop control
- Signal control
- Yield control
- Extent of 95th Queue

Figure 5

PM Peak Period
Queuing Results



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Transportation Analysis for Hayden Island Concept Plan

Legend
- Stop control
- Signal control
- Yield control
- Extent of 95th Queue

Figure 6

Weekend Peak Period Queuing Results

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Transportation Analysis for Hayden Island Concept Plan

Legend

— Proposed Bridge Location

Figure 7

Proposed Arterial Bridge Locations

Appendix

Appendix A: 2007 Roadway Inventory - Hayden Island - City of Portland, Oregon

Street	Jurisdiction	ODOT Classification	City of Portland Street Classification					City of Portland Recommended Speed Limit	Speed Limit (mph)	# of Travel Lanes	Travel Lane Type	Center Turn Lane	On-street Parking	Street Trees	Sidewalks	Bike Lanes	Comments
			Traffic	Transit	Freight	Bicycle	Pedestrian										
Image Canoe Ave	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	No	No	
N Scouler Ave	Private	Local Road	Local Service					20-25	10	2	Narrow	No	West side	No	No	No	
Fir	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	Yes	No	Sidewalks are narrow, approximately 2 feet wide
Elm	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	Yes	No	Sidewalks are narrow, approximately 2 feet wide
Dogwood	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	Yes	No	Sidewalks are narrow, approximately 2 feet wide
Cypress	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	Yes	No	Sidewalks are narrow, approximately 2 feet wide
Birch	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	Yes	No	Sidewalks are narrow, approximately 2 feet wide
Alder	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	Yes	No	Sidewalks are narrow, approximately 2 feet wide
Daphne	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	Yes	No	Sidewalks are narrow, approximately 2 feet wide
Camelia	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	Yes	No	Sidewalks are narrow, approximately 2 feet wide
Begonia	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	Yes	No	Sidewalks are narrow, approximately 2 feet wide
Azalia	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	Yes	No	Sidewalks are narrow, approximately 2 feet wide
N Broughton Ct	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	No	No	
N Broughton Dr	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	Yes	No	Sidewalks are narrow, approximately 2 feet wide
Arbor Ave	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	Yes	No	Sidewalks are narrow, approximately 2 feet wide
N Menzies Dr	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	Yes	No	Sidewalks are narrow, approximately 2 feet wide
Columbia Dr	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	Yes	No	Sidewalks are narrow, approximately 2 feet wide
River Dr	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	Yes	No	Sidewalks are narrow, approximately 2 feet wide
Garden Ave	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	Yes	No	Sidewalks are narrow, approximately 2 feet wide
Flower Ave	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	Yes	No	Sidewalks are narrow, approximately 2 feet wide
Janzen Beach RV Park	Private	Local Road	Local Service					20-25	10	2	Narrow	No	No	No	No	No	
N S Shore Ave	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	No	No	
N Westshore Dr	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	No	No	
N Middle Shore St	Private	Local Road	Local Service					20-25	10	2	Narrow	No	Yes	No	No	No	
N Jantzen Beach Center																	
Between Circuit City and Toys R Us	Private	N/A	N/A					N/A	15	2	Standard	No	No	No	No	No	
Between Circuit City and Copeland's Sports	Private	N/A	N/A					N/A	15	2	Standard	No	No	No	No	No	
Immediately west of SuperCenter Mall	Private	N/A	N/A					N/A	15	2	Standard	No	No	No	No	No	
Immediately east of SuperCenter Mall	Private	N/A	N/A					N/A	15	2	Standard	No	No	No	No	No	
North of Home Depot	Private	N/A	N/A					N/A	15	2	Standard	No	No	No	No	No	
North of SuperCenter Mall	Private	N/A	N/A					N/A	15	2	Standard	No	No	No	No	No	
N Jantzen Ave	Private	Local Road	Local Service					20-25	Not posted	2	Standard	No	No	No	No	No	
N Center Ave																	
Main Dr to N North Hayden Island Dr	ODOT	Local Road	District Collector	Community Transit Street	Major Truck Street	Local Service Bikeway	City Walkway	20-40	25	4	Standard	No	No	West side	West side	No	
Main Dr to beginning on southbound I-5 on-ramp	ODOT	Local Road	District Collector	Community Transit Street	Local Service Truck Street	Local Service Bikeway	City Walkway	20-40	25	2	Standard	No	No	West side	West side	No	
K-Mart Dr to N Jantzen Dr	Private	Local Road	District Collector	Community Transit Street	Local Service Truck Street	Local Service Bikeway	City Walkway	20-40	25	2	Standard	No	No	No	No	No	
Main Dr	Private	Local Road	Local Service Street	Community Transit Street	Major Truck Street	Local Service Bikeway	Local Service Walkway	20-25	15	4	Standard	No	No	North side	North side	No	
Kmart Dr	Private	Local Road	Local Service Street	Community Transit Street	Local Service Truck Street	Local Service Bikeway	Local Service Walkway	20-25	15	2	Standard	No	South side	North side	North side	No	
N Hayden Island Drive																	
Portland Auto Auction property to end	PDOT	Local Road	District Collector	Local Service Street	Major Truck Street	Local Service Bikeway	City Walkway	20-40	25	2	Standard	No	Yes[1]	South side	Yes	No	[1] No parking along south side of street for 700' north of Portland auto auction entrance
Portland Auto Auction property to N S Shore Ave	PDOT	Local Road	District Collector	Local Service Street	Major Truck Street	Local Service Bikeway	City Walkway	20-40	25	2	Standard	No	Yes	Yes[2]	Yes	No	[2] Street trees are also located in the median
N S Shore Ave to end of center median	PDOT	Rural Major Collector	District Collector	Local Service Street	Major Truck Street	Local Service Bikeway	City Walkway	20-40	25	2	Standard	No	Yes	Yes[3]	Yes	No	[3] Street trees are also located in the median
Center median end to N Jantzen Beach Center (Between Circuit City and Sports Authority)	PDOT	Rural Major Collector	District Collector	Local Service Street	Major Truck Street	Local Service Bikeway	City Walkway	20-40	25	2	Standard	Yes	Yes	South side	South side	No	

Appendix A: 2007 Roadway Inventory - Hayden Island - City of Portland, Oregon

Street	Jurisdiction	ODOT Classification	City of Portland Street Classification					City of Portland Recommended Speed Limit	Speed Limit (mph)	# of Travel Lanes	Travel Lane Type	Center Turn Lane	On-street Parking	Street Trees	Sidewalks	Bike Lanes	Comments
			Traffic	Transit	Freight	Bicycle	Pedestrian										
N Jantzen Beach Center (Between Circuit City and Sports Authority) to N Jantzen Beach Center (Immediately east of SuperCenter Mall)	PDOT	Rural Major Collector	District Collector	Local Service Street	Major Truck Street	Local Service Bikeway	City Walkway	20-40	25	2	Standard	Yes	No	South side	Yes	No	
N North Hayden Island Dr to N Jantzen Dr	PDOT	Local Road	District Collector	Local Service Street	Local Service Truck Street	Local Service Bikeway	City Walkway	20-40	25	2	Standard	Yes	No	North side	No	No	
N South Hayden Island Dr to Jantzen Dr	ODOT	Local Road	Regional Trafficway	Community Transit Street	Major Truck Street	Local Service Bikeway	Local Service Walkway	40-55	25	3	Standard	No	No	No	No	No	
N Jantzen Dr to N Jantzen Beach Ave	PDOT	Local Road	District Collector	Local Service Street	Local Service Truck Street	Local Service Bikeway	Local Service Walkway	20-40	25	2	Standard	No	No	Yes	South side	No	
N Jantzen Beach Ave to N Hayden Bay Dr	Private	Local Road	District Collector	Local Service Street	Local Service Truck Street	Local Service Bikeway	Local Service Walkway	20-40	25	2	Narrow	No	North side	South side	South side	No	
N Jantzen Dr																	
N Center Ave to N Tomahawk Dr	Private	Local Road	Neighborhood Collector	Community Transit Street	Local Service Truck Street	Local Service Bikeway	City Walkway	20-35	25	2	Standard	No	No	Yes	East side	No	
N Tomahawk Dr to N Hayden Island Dr	Private	Local Road	Neighborhood Collector	Community Transit Street	Local Service Truck Street	Local Service Bikeway	City Walkway	20-35	25	2	Standard	No	Yes	No	Yes	No	
N Jantzen Beach Ave	Private	Local Road	Local Service					20-25	Not posted	2	Standard	No	No	No	No	No	
N Tomahawk Island Dr																	
N Hayden Island Dr to N Jantzen Dr	PDOT	Local Road	Neighborhood Collector	Local Service Street	Local Service Truck Street	Local Service Bikeway	City Walkway	20-35	25	2	Standard	No	No	South side	Yes	No	
N Jantzen Dr to N Jantzen Beach Ave	PDOT	Local Road	Neighborhood Collector	Local Service Street	Local Service Truck Street	Local Service Bikeway	City Walkway	20-35	25	2	Standard	Yes	No	South side	Yes	No	
N Jantzen Beach Ave to access road to Lotus Beach Dr and Lotus Isle Dr	PDOT	Local Road	Neighborhood Collector	Local Service Street	Local Service Truck Street	Local Service Bikeway	City Walkway	20-35	25	2	Standard	No	No	Yes	Yes[4]	No	[4] There is only a sidewalk on the south side of the street until about 500' west of access road to Lotus Beach Dr and Lotus Isle Dr. At that point, there is a sidewalk only on the north side of the street
Access road to Lotus Beach Dr and Lotus Isle Dr to NE Tomahawk Island Dr	PDOT	Local Road	Neighborhood Collector	Local Service Street	Local Service Truck Street	Local Service Bikeway	City Walkway	20-35	25	2	Standard	No	Yes	Yes	North side	No	
NE Tomahawk Island Dr																	
Marine Works to Sundance Marine	PDOT	Local Road	Neighborhood Collector	Local Service Street	Local Service Truck Street	Local Service Bikeway	City Walkway	20-35	25	2	Narrow	No	Yes	Yes	North side	No	
Sundance Marine to end	Private	Local Road	Neighborhood Collector	Local Service Street	Local Service Truck Street	Local Service Bikeway	City Walkway	20-35	25	2	Narrow	No	No	Yes	North side	No	
Jantzen Beach Village Condominiums																	
N Jantzen Beach Ave to N Hayden Bay Dr	Private	Local Road	Local Service					20-25	Not posted	2	Narrow	No	No	No	No	No	
N Jantzen Beach Ave to N Hayden Island Dr	Private	Local Road	Local Service					20-25	Not posted	2	Narrow	No	No	No	No	No	
Jantzen Beach Village Condominiums to N Hayden Island Dr	Private	Local Road	Local Service					20-25	Not posted	2	Narrow	No	No	No	No	No	
Columbia Point W Condominiums	Private	Local Road	Local Service					20-25	Not posted	2	Narrow	No	No	No	East side	No	
Columbia Point Condominiums	Private	Local Road	Local Service					20-25	Not posted	2	Narrow	No	No	No	No	No	
N Hayden Bay Dr	Private	Local Road	Local Service					20-25	25	2	Narrow	No	Yes	North side	No	No	
N Lotus Beach Dr	Private	Local Road	Local Service					20-25	Not posted	2	Narrow	No	No	No	No	No	
N Lotus Island Dr	Private	Local Road	Local Service					20-25	Not posted	2	Narrow	No	No	No	No	No	

Data Sources

Field Observation

Aerial photos. Metro RLIS, http://maps.google.com, and http://maps.live.com

PortlandMaps.com. Data provided by the City of Portland and Multnomah County

Oregon Transportation Map Showing Functional Classification of Roads. (7) Portland Quad. ODOT

Hayden Island Plan. City of Portland

Transportation System Plan. City of Portland

Appendix B: Hayden Island Concept Plan Trip Generation

							Theoretical Trip Generation					
							Weekday PM			Weekend Peak		
Letter	#	Subarea	ITE	Land use	Size	Units	Trips	In	Out	Trips	In	Out
A	1	1	-	Port of Portland development	270	Acres	156	63	93	280	128	152
B	2	2	110	General light industrial	180,120	Gross sq. ft	208	25	183	25	12	13
	3	3	110	General light industrial	273,553	Gross sq. ft	315	38	277	38	18	20
		3	230	Residential condominium/townhouse	47	Units	32	22	11	56	30	26
		3	-	Combination of office/light industrial	86,542	Gross sq. ft	194	29	165	22	11	11
C	4	4	416	RV Park	166	Sites	61	42	19	61	42	19
		4	240	Mobile home park	352	Units	222	138	84	164	87	77
		4	820	Shopping center	9,240	Gross sq. ft	35	17	18	48	25	23
		4	912	Drive-in bank	4,840	Gross sq. ft	221	111	111	179	92	88
D	5	5	240	Mobile home park	79	Units	95	59	36	48	25	23
	6, 8	50	310	Hotel	74	Rooms	44	23	21	55	31	24
		50	820	Shopping center	37,577	Gross sq. ft	144	69	75	197	102	94
		51	230	Residential condominium/townhouse	35	Units	25	17	8	53	29	24
		52	411	City park	1	Acres	10	5	5	10	5	5
		53	220	Apartment	60	Units	51	33	18	44	28	15
		54	230	Residential condominium/townhouse	22	Units	17	12	6	49	26	23
		55	230	Residential condominium/townhouse	16	Units	13	9	4	47	26	22
		56	220	Apartment	40	Units	40	26	14	36	23	12
		57	220	Apartment	60	Units	51	33	18	44	28	15
		57	820	Shopping center	15,000	Gross sq. ft	58	28	30	79	41	38
		58	220	Apartment	60	Units	51	33	18	44	28	15
		58	820	Shopping center	22,000	Gross sq. ft	84	41	44	115	60	55
	9	59	820	Shopping center	25,000	Gross sq. ft	96	46	50	131	68	63
		59	820	Shopping center	52,000	Gross sq. ft	200	96	104	272	142	131
		60	220	Apartment	60	Units	51	33	18	44	28	15
		60	820	Shopping center	17,000	Gross sq. ft	65	31	34	89	46	43
		61	220	Apartment	40	Units	40	26	14	36	23	12
		62	220	Apartment	40	Units	40	26	14	36	23	12
		63	220	Apartment	60	Units	51	33	18	44	28	15
		63	820	Shopping center	16,000	Gross sq. ft	61	29	32	84	44	40
	7	7	230	Residential condominium/townhouse	96	Units	58	39	19	70	38	32
E, G	10, 12	64	220	Apartment	60	Units	51	33	18	44	28	15
		64	411	City park	0.5	Acres	5	2	3	5	3	2
		64	820	Shopping center	16,000	Gross sq. ft	61	29	32	84	44	40
		65	220	Apartment	40	Units	40	26	14	36	23	12
		66	220	Apartment	40	Units	40	26	14	36	23	12
		67	220	Apartment	60	Units	51	33	18	44	28	15
		67	411	City park	0.5	Acres	5	2	3	5	3	2
		67	820	Shopping center	15,000	Gross sq. ft	58	28	30	79	41	38
		68	820	Shopping center	49,000	Gross sq. ft	188	90	98	256	133	123
		68	820	Shopping center	120,000	Gross sq. ft	461	221	240	628	327	301
		69	220	Apartment	80	Units	62	40	22	52	34	18
		69	411	City park	0.5	Acres	5	2	3	5	3	2
		69	820	Shopping center	27,000	Gross sq. ft	104	50	54	141	73	68
F	11	72	411	City park	12	Acres	120	60	60	120	60	60
H, J	13	13	820	Shopping center	24,000	Gross sq. ft	126	60	65	173	90	83
		13	820	Shopping center	62,000	Gross sq. ft	324	156	169	446	232	214
	14	14	820	Shopping center	29,000	Gross sq. ft	152	73	79	209	109	100
		14	820	Shopping center	36,500	Gross sq. ft	191	92	99	263	137	126
	16	16	310	Hotel	200	Rooms	118	63	55	142	80	63
		16	820	Shopping center	18,000	Gross sq. ft	94	45	49	130	67	62
	20	20		Hayden Island Fire Station	4,896	Gross sq. ft	5	3	2	5	2	3
		20	420	Marina	539	Berths	102	61	41	146	64	81
I	15	15	310	Hotel	318	Rooms	188	99	88	224	125	98
K	17	17	710	General office building	47,242	Gross sq. ft	132	22	109	20	11	9
	18	18	230	Residential condominium/townhouse	144	Units	81	54	27	84	46	39
	19	19	230	Residential condominium/townhouse	280	Units	140	94	46	124	67	57
	21	21	230	Residential condominium/townhouse	73	Units	46	31	15	64	34	29
	22	22	230	Residential condominium/townhouse	99	Units	60	40	20	71	39	33
L	23	23	210	Single family detached	54	Units	62	39	23	59	37	22
		23	230	Residential condominium/townhouse	70	Units	45	30	15	63	34	29
	24	24.1	420	Marina	305	Berths	58	35	23	82	36	46
		24.1	220	Apartment	133	Units	91	59	32	74	48	26
		24.1	220	Apartment	133	Units	91	59	32	74	48	26
		24.1	230	Residential condominium/townhouse	133	Units	76	51	25	81	44	37
		24.2	110	General light industrial	32,540	Gross sq. ft	38	5	33	5	2	2
		24.2	420	Marina	343	Berths	65	39	26	93	41	52
	25	25	230	Residential condominium/townhouse	206	Units	109	73	36	102	55	47
		25	420	Marina	195	Berths	37	22	15	53	23	29
	26	26	110	General light industrial	103,210	Gross sq. ft	119	14	105	14	7	8
		26	220	Apartment	133	Units	91	59	32	74	48	26
		26	220	Apartment	133	Units	91	59	32	74	48	26
		26	230	Residential condominium/townhouse	163	Units	90	60	30	90	49	41
		26	420	Marina	792	Berths	150	90	60	214	94	120
		26	411	City park	1	Acres	10	5	5	10	5	5

Theoretical Trip Generation Totals	**7,018**	**3,464**	**3,554**	**7,295**	**3,884**	**3,411**
Calibration Factors Retail trips	2,724	1,312	1,412	3,602	1,871	1,731
25%/15% factor	681	328	353	540	281	260
Calibrated retail	**2,043**	**984**	**1,059**	**3,062**	**1,590**	**1,471**
Non-Retail trips	4,294	2,152	2,142	3,693	2,013	1,680
17.5%/7.5% factor	751	377	375	277	151	126
Calibrated non-retail	**3,542**	**1,776**	**1,767**	**3,416**	**1,862**	**1,554**
Total calibrated trips	**5,586**	**2,760**	**2,826**	**6,477**	**3,452**	**3,025**
Internal Capture 25%/20% weekday PM	1,396	690	706	1,295	690	605
Mode Split 10.6% in, 5.8% out	342	219	123	346	235	111
Total trips at I-5 ramps	**3,847**	**1,850**	**1,997**	**4,836**	**2,527**	**2,309**

Appendix C: Queuing Results

Hayden Island Concept Plan - Queuing Results - Weekday PM Peak Hour

Intersection	Approach/Movement	Available Storage	Queue Length
South Ramp Terminal - Center	Eastbound Left	400	250
	Eastbound Thru	600	200
	Westbound Thru	185	35
	Southbound Left	150	100
South Ramp Terminal - East	Westbound Thru	730	200
	Westbound Right	200	165
South Ramp Terminal - West	Westbound Thru	200	65
	Southbound Right	120	55
Hayden Island Dr and Jantzen Dr	Eastbound Left	100	35
	Eastbound Thru	445	90
	Eastbound Right	445	140
	Westbound Left	150	70
	Westbound Thru/Right	485	65
	Northbound Left	250	135
	Northbound Left	550	80
	Northbound Thru/Right	550	65
	Southbound Left/Thru/Right	365	65
North Ramp Terminal - East	Northbound Right	80	50
North Ramp Terminal - Center	Eastbound Thru	530	25
	Westbound Left	280	165
	Westbound Thru	570	110
	Northbound Left	1,045	170
North Ramp Terminal - West	Eastbound Thru	1,065	100
	Eastbound Right	150	95
Hayden Island Dr and Sunrise	Northbound Right	240	60
	Southbound Right	325	40
Hayden Island Dr and Main	Eastbound Left	150	55
	Eastbound Thru/Right	550	60
	Westbound Left	350	135
	Westbound Thru/Right	550	110
	Westbound Right	550	40
	Northbound Left	150	25
	Northbound Thru	540	55
	Northbound Right	540	95
	Southbound Left	100	80
	Southbound Thru/Right	630	75
Hayden Island Dr and Sunset	Northbound Left/Thru/Right	560	65
	Southbound Left/Thru/Right	670	45
Hayden Island Dr and South Shore Ave	Northbound Left/Right	160	70
Tomahawk Island Dr and Main	Eastbound Left/Thru/Right	550	85
	Westbound Left/Thru/Right	590	125
	Northbound Left	150	55
	Northbound Thru	455	80
	Northbound Right	455	60
	Southbound Left	150	75
	Southbound Thru	540	200
	Southbound Right	540	30
Tomahawk Island Dr and Sunrise	Eastbound Left/Thru	590	65
	Westbound Thru/Right	1,365	80
	Northbound Left/Right	450	65
Tomahawk Island Dr and Sunset	Eastbound Left/Thru/Right	800	55
	Westbound Left/Thru/Right	550	55
	Northbound Left/Thru/Right	470	55
	Southbound Left/Thru/Right	560	55
Tomahawk Island Dr and South Shore Ave	Westbound Left/Right	800	40
Jules Verne and Main	Eastbound Left/Thru/Right	550	50
	Westbound Left/Thru/Right	600	85
	Northbound Left	150	55
	Northbound Thru	295	95
	Northbound Right	295	40
	Southbound Left	150	35
	Southbound Thru	455	230
	Southbound Right	455	25
Jules Verne and Sunrise	Eastbound Left/Right	600	50
	Northbound Left/Thru/Right	300	50
	Southbound Thru/Right	450	45
Jules Verne and Sunset	Eastbound Left/Thru/Right	815	50
	Westbound Left/Thru/Right	550	50
	Northbound Left/Thru/Right	310	60
	Southbound Left/Thru/Right	470	45
Jules Verne and South Shore Ave	Eastbound Left/Thru/Right	290	45
	Westbound Left/Thru/Right	815	40
	Northbound Left/Thru/Right	215	15
	Southbound Left/Thru/Right	470	15
Jantzen Ave and Main	Eastbound Left	100	25
	Eastbound Thru	565	105
	Westbound Thru	600	125
	Westbound Right	600	80
	Southbound Left	295	125
	Southbound Left/Right	295	110
Jantzen Ave and Sunset	Southbound Left/Right	310	55
Jantzen Ave and Sunrise	Southbound Right	300	35
Tomahawk Island Dr and Jantzen Dr	Eastbound Left	250	95
	Eastbound Thru/Right	1,365	115
	Westbound Left	300	190
	Westbound Thru/Right	870	115
	Northbound Left	150	70
	Northbound Thru	480	170
	Northbound Right	480	160
	Southbound Left	300	210
	Southbound Thru	550	135
	Southbound Right	550	70

Appendix C: Queuing Results

Hayden Island Concept Plan - Queuing Results - Weekend Midday Peak Hour

Intersection	Approach/Movement	Available Storage	Queue Length
South Ramp Terminal - Center	Eastbound Left	400	210
	Eastbound Thru	600	80
	Westbound Thru	185	30
	Southbound Left	150	150
South Ramp Terminal - East	Westbound Thru	730	275
	Westbound Right	200	195
South Ramp Terminal - West	Westbound Thru	200	60
	Southbound Right	120	70
Hayden Island Dr and Jantzen Dr	Eastbound Left	100	60
	Eastbound Thru	445	105
	Eastbound Right	445	210
	Westbound Left	150	70
	Westbound Thru/Right	485	70
	Northbound Left	250	200
	Northbound Left	550	235
	Northbound Thru/Right	550	55
	Southbound Left/Thru/Right	365	75
North Ramp Terminal - East	Northbound Right	80	70
North Ramp Terminal - Center	Eastbound Thru	530	25
	Westbound Left	280	215
	Westbound Thru	570	140
	Northbound Left	1,045	150
North Ramp Terminal - West	Eastbound Thru	1,065	115
	Eastbound Right	150	115
Hayden Island Dr and Sunrise	Northbound Right	240	85
	Southbound Right	325	30
Hayden Island Dr and Main	Eastbound Left	150	45
	Eastbound Thru/Right	550	200
	Westbound Left	350	225
	Westbound Thru/Right	550	120
	Westbound Right	550	45
	Northbound Left	150	45
	Northbound Thru	540	75
	Northbound Right	540	115
	Southbound Left	100	70
	Southbound Thru/Right	630	60
Hayden Island Dr and Sunset	Northbound Left/Thru/Right	560	65
	Southbound Left/Thru/Right	670	65
Hayden Island Dr and South Shore Ave	Northbound Left/Right	160	65
Tomahawk Island Dr and Main	Eastbound Left/Thru/Right	550	100
	Westbound Left/Thru/Right	590	140
	Northbound Left	150	80
	Northbound Thru	455	85
	Northbound Right	455	100
	Southbound Left	150	85
	Southbound Thru	540	90
	Southbound Right	540	110
Tomahawk Island Dr and Sunrise	Eastbound Left/Thru	590	95
	Westbound Thru/Right	1,365	120
	Northbound Left/Right	450	115
Tomahawk Island Dr and Sunset	Eastbound Left/Thru/Right	800	55
	Westbound Left/Thru/Right	550	65
	Northbound Left/Thru/Right	470	50
	Southbound Left/Thru/Right	560	60
Tomahawk Island Dr and South Shore Ave	Westbound Left/Right	800	55
Jules Verne and Main	Eastbound Left/Thru/Right	550	70
	Westbound Left/Thru/Right	600	100
	Northbound Left	150	50
	Northbound Thru	295	80
	Northbound Right	295	85
	Southbound Left	150	55
	Southbound Thru	455	95
	Southbound Right	455	105
Jules Verne and Sunrise	Eastbound Left/Right	600	55
	Northbound Left/Thru/Right	300	65
	Southbound Thru/Right	450	45
Jules Verne and Sunset	Eastbound Left/Thru/Right	815	45
	Westbound Left/Thru/Right	550	50
	Northbound Left/Thru/Right	310	60
	Southbound Left/Thru/Right	470	50
Jules Verne and South Shore Ave	Eastbound Left/Thru/Right	290	45
	Westbound Left/Thru/Right	815	45
	Northbound Left/Thru/Right	215	20
	Southbound Left/Thru/Right	470	10
Jantzen Ave and Main	Eastbound Left	100	35
	Eastbound Thru	565	95
	Westbound Thru	600	110
	Westbound Right	600	90
	Southbound Left	295	120
	Southbound Left/Right	295	110
Jantzen Ave and Sunset	Southbound Left/Right	310	55
Jantzen Ave and Sunrise	Southbound Right	300	45
Tomahawk Island Dr and Jantzen Dr	Eastbound Left	250	165
	Eastbound Thru/Right	1,365	210
	Westbound Left	300	250
	Westbound Thru/Right	870	280
	Northbound Left	150	75
	Northbound Thru	480	175
	Northbound Right	480	240
	Southbound Left	300	290
	Southbound Thru	550	200
	Southbound Right	550	190

Appendix D: Assessment of Arterial Bridge Options

Assessment of Arterial Bridge Options*				
Assessment Criteria	**Lotus Isle Park**	**Force Avenue**	**Portland Auto Auction**	**West Hayden Island**
Access to Portland Street Network	Bridge would connect to North Harbor Drive and then to Marine Drive east of I-5 and would provide access to Portland street network to the south via MLK	Bridge would connect to Marine Drive at Force Avenue intersection and would provide access to Portland street network to the south via Force Avenue and Expo Drive.	Bridge would connect to Marine Drive west of Force Avenue intersection and would provide access to Portland street network to the south via Force Avenue and Expo Drive.	Bridge would connect to Marine Drive west of the railroad tracks and would provide access to Portland street network to the south via North Portland Road, Force Avenue and Expo Drive.
Access to Hayden Island Street Network	Access to Hayden Island would be from North Tomahawk Island Drive	Access to Hayden Island would be from an extension of Force Avenue with an intersection at North Jantzen Beach Drive and then extending to North Hayden Island Drive	Access to Hayden Island would be from a new road through the industrial area at the west end of East Hayden Island connecting with North Hayden Island Drive.	Access to Hayden Island would be from a new road through part of West Hayden Island that connects to the western end of North Hayden Island Drive.
Impact on Hayden Island Residents	Would adversely impact East Hayden Island residents with potential truck traffic going through the residential portions of the Island on both the east and west sides of I-5.	Would adversely impact Jantzen Beach moorage residents by requiring relocation and would adversely impact Hayden Island Manufactured Home Park and West Hayden Island moorage with additional traffic on this side of the Island, including potential truck traffic.	Would adversely impact West Hayden Island moorage residents by requiring relocation and would adversely impact Hayden Island Manufactured Home Park and West Hayden Island moorage with additional traffic on this side of the Island, including potential truck traffic.	There would be no impact on Hayden Island residents by increased traffic to Hayden Island. Only residential traffic would use the local streets after crossing the bridge.
Impact on Other Community Residents	Would impact Bridgeton residents with additional traffic and potential loss of house boat moorage on the south side of North Portland Harbor.	No impact on other Portland residential communities. There is a moorage on the south side of North Portland Harbor.	No impact on other Portland residential communities.	No impact on other Portland residential communities.
Access to Potential Port Facilities	Would be the least accessible route and cause the most impact on	Would provide access to Port facilities while having a significant impact on the	Would provide access to Port facilities while having an impact on the western	Would provide most direct access to Port facilities and have no impact or

* Each of the bridge proposals assumes a bridge 30 feet above North Portland Harbor to provide for boat navigation. This assessment assumes that there is only one arterial bridge constructed for Hayden Island.

Source: City of Portland

Appendix D: Assessment of Arterial Bridge Options

Assessment of Arterial Bridge Options*				
Assessment Criteria	**Lotus Isle Park**	**Force Avenue**	**Portland Auto Auction**	**West Hayden Island**
	other residential and commercial properties.	western half of East Hayden Island.	half of East Hayden Island. Current land use does not provide an opportunity for access or construction of this option on Hayden Island.	limited impact on the western half of East Hayden Island.
Impact to Marine Drive	Would intersect with Marine Drive in Bridgeton and may impact the network	Would intersect with Marine Drive west of Expo Center and may impact the network in close proximity to the Marine Drive interchange Expo Drive is a two-lane road with limited capacity	Would intersect Marine Drive just east of the railroad bridge and may impact the network	Would intersect Marine Drive west of the railroad bridge and may impact the network
Impact to Expo Center	No impact	Potential impact	No impact	No impact
Pursue Joint Development	No opportunity	Possible CRC opportunity	Possible CRC opportunity	Possible CRC and Port of Portland opportunity
Pedestrian/Bike Facilities	Can be incorporated into the project. Good connections with Bridgeton and for Hayden Island	Can be incorporated into the project. May be connected to Expo Center	Can be incorporated into the project. Not very conducive to connections south of North Portland Harbor	Can be incorporated into the project. May provide good access to future environmental enhancement area.
Island Continuity	Would disconnect the eastern edge of the Island with increased traffic	Would create southern barrier along Jantzen Beach Drive and further separate the Jantzen Beach moorage from the Island	Would not impact Island continuity	Would not impact Island continuity
Other	This location would eliminate most of the only existing park on the Island. Would be a good location for a pedestrian and bicycle only bridge – which could provide emergency only access.			

Source: City of Portland